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THE INDIGENOUS TANS AND VEGETABLE DYESTUFFS OF NEW ZEALAND.

I. HISTORICAL AND INTRODUCTORY.

B. C. ASTON, Chemist to the Department.

THE utilization of the products of forest land other than millable timber is a problem which has not yet received a satisfactory solution in this country. Although timber besides that previously considered marketable, such as tawa, rata, mangeao, &c., is now finding a market, there is still much left which is not utilized after the sawmillers have gone through a block of country. This is to some extent perhaps unavoidable in a new, sparsely settled country where manufactures are few and the outlet for such by-products of the destructive distillation of wood as acetone, methyl-alcohol (wood-spirit), acetic acid, charcoal, and wood-tar and its products is strictly limited. Oxalic acid, previously made from wood sawdust, is now largely made from another source. Acetic acid was made into vinegar, but this is now prohibited in most countries with enlightened public-health laws, and the term "vinegar" is restricted to a product of fermentation. Again, in thickly populated countries there is an outlet for sawdust for packing, for bedding animals, for manufacture into various articles, fuel briquettes, and a host of

other uses.* Much of the smaller timbers would find useful applications in a larger country where competition is keener. One would certainly not see such valuable woods as kohekohe, or New Zealand mahogany (*Dysoxylum*), carted about and sold as firewood, as is now done in Wellington.

If we except the "beer" made from the rimu for his scurvy-stricken sailors by Cook in Dusky Sound, perhaps one of the first forest by-products utilized by Europeans was the bark from certain indigenous trees used for tanning the leather required for the infant colony. It is here intended to introduce the subject of the utilization of forest by-products by a study of the Maori methods of producing colours, the permanency and brightness of which were the admiration of all in those days in which vegetable and animal colours were almost universally used. In this connection J. C. Andersen† quotes from page 71 of the Official Catalogue of the New Zealand Exhibition, 1865, that "minute information is much required connected with the method and substances used in dyeing the flax with these brilliant fast colours in which the Maoris have excelled," from which he concludes that even so late as 1865 the Maori people excelled us both in the preparation of the flax-fibre and the dyeing of it.

In a future number of the *Journal* the use in later days of indigenous tans will be dealt with.

DYES OF THE ANCIENT MAORI.

Nicholas‡ (1817) relates how he observed near a Maori dwelling a capacious vessel in the shape of a flat-bottomed boat, in which was steeping the bark of a tree called "enou," from which the Natives extract a black colour that serves them to dye their flax with. By "enou" is no doubt meant hinau (*Elaeocarpus dentatus*), a common tree in lowland forests in the North Island and extending as far south as Catlin's River in Otago. This tree is that most often mentioned in early books on New Zealand in connection with Maori methods of dyeing. Craik§ (1830) says, "Among those trees which the Natives principally make use of is the 'henow,' from which they extract a black dye." Yate‖ (1835) states that hinau makes an excellent dye, either a light-brown or puce colour or a deep black, not removable by washing. The Natives use the outer skin of the

* The utilization of sawdust and wood-waste in thickly populated countries may be classified under the following heads: (1) Employment as fuel; (2) dry distillation to make wood spirit, wood-tar, acetic acid, acetone, and charcoal; (3) chemical treatment to produce cellulose (wood-pulp), vinegar, alcohol, sugar, gum, and oxalic acid; (4) usage for production of artificial wood; (5) employment in the manufacture of explosives; (6) usage as a diluent to produce porosity and lightness in manufactures; (7) usage by gardeners and intensive farmers to produce hotbeds, composts, and manure; (8) a variety of miscellaneous and minor uses. † "Maori Life in Aotea," p. 324. ‡ "Narrative of a Voyage in New Zealand," vol. i, p. 340. § "The New-Zealanders," p. 175. ‖ "An Account of New Zealand," p. 49.

bark for the purpose of dyeing the black threads of their garments. The bark only requires to be pounded and thrown into water and the article to be dyed immersed in the solution. Of course, according to strength is the deepness of colour. Polack* (1840) makes a general statement that dyeing is much used by the females, but from white to a red and deep jet black are the sole colours obtained by steeping the prepared flax in water with the bark (sometimes crushed) of certain trees; and he makes the interesting remark that the process is so rude as to rot and damage the texture of the article in some degree.

Wade† (1842) mentions the tanekaha (*Phyllocladus trichomanoides*), which is used as a red dye for the ornamental parts of the Native *kaitaka*, their best bordered garment, the bark being first cut off in pieces, beaten with a stone pounder, and when so softened put into cold water in a *kumete* (a kind of trough resembling a short, ill-shaped canoe) along with the *muka*, or prepared flax. Stones made red-hot are then thrown into the water until it boils, the process being continued until the *muka* is dyed red, when it is finally taken out and dried. For making a black dye hinau-bark is used in the same way, with the exception that when the *muka* has reached the drying stage and has been hung up and dried, and is now of a red colour, it is steeped in the black mud of a swamp, and then left for a short time in a heap of mud. He states that if left too long it will lose its colour. By testing a portion from time to time by washing off the mud in the nearest water the operation is known to be completed by the flax remaining perfectly black. An anonymous writer‡ (1842), after saying that the "inau" tree yields a beautiful black dye, makes the novel statement that a fine scarlet dye may be procured from the orchilla, a species of lichen found between Waikato and Taupo.

Dieffenbach§ (1843) mentions the very durable and jet-black dye which the Maoris obtained from the hinau, and gives the further interesting information that in the process a greenish mud which is obtained from the rivers, and probably contained "muriate of iron," is macerated with the bark of the tree and the flax. Dieffenbach's mention of muriate of iron is interesting. It is the natural speculation that would occur to a chemist—namely, that a tannate of iron or ink is formed in the tissues of the fibre by the Maori process. After stating that all the tanned leather then used in New Zealand was either tanned at the Bay of Islands or at Port Nicholson (he infers with native barks), he goes on to describe the Maori process of using tanekaha and hinau bark as given under Wade. He states that both hinau and tanekaha are used for tanning, and the production of mimosa-bark of Tasmania having fallen off as an export to Sydney, tanners there were looking to New Zealand for supplies, as much as

* "Manners and Customs of the New-Zealanders," p. 177. † "A Journey in the North Island of New Zealand," p. 42. ‡ "New Zealand Journal," p. 279. § "Travels in New Zealand," p. 302.

£20 per ton having been offered for good New Zealand native bark, and draws attention to the fastness of New Zealand colours from hinau-bark, which compare favourably with the black dyes then used in the cloth industry of New South Wales, which of all colours were the most fleeting.

The "New Zealand Journal"* (1846) states that tanekaha yields a black or brown dye from the wood and bark; hinau, tupakihi (tutu), and tuhuhi yield a black dye from the wood and bark; mako (*Aristotelia racemosa*) yields a black dye from the wood and bark; and whakou (*Eugenia maire*) yields a blue dye from the wood and bark. This article states that the best two dyes for domestic purposes are mako and whakou. "Tuhuhi" is possibly the same as "whakou." The same journal† in 1848 quotes Mr. Bennett in describing the method of dyeing with tanekaha as already described, and states that the boiling is continued for some hours. McKillop‡ (1849) states that the tanekaha yields a black or brown dye, the tuhuhi a blue-black, and the mako a blue-black from the wood and bark; the whakou also yields a handsome blue. Shortland§ (1851) says that the wood and bark of the tutu (*Coriaria sarmentosa*) furnish a good black dye. Thomson‖ (1859) states that dark dye is extracted from six plants, and reverses the order in which the flax to be dyed is placed in the mud—*i.e.*, it is placed in the mud first and in the dye afterwards. He also states that a yellow colour is given to flax by holding the fresh leaves over fire.

John White¶ states that the bark of tanekaha or toatoa is powdered and placed in a *kumete* with water, which yields a yellowish pink or red dye for the flax of the *kaitaka* and other mats. To make this dye a good pink the weed called kakariki is taken and bruised into a pulp and placed in the dye. To make the dye a good yellow the bark of the puriri (*Vitex littoralis*) is bruised and put in the dye, or the bark of the tree is steeped in water in a *kumete*, and the flax used in making the mats is steeped in it to a brownish-yellow colour. To make it a good yellow, some of the bark of the tanekaha is used with the puriri. This is the first occasion that the puriri is mentioned by writers on Maori lore, which is somewhat remarkable. It may here also be mentioned that the puriri dye is the only native vegetable dye the chemistry of which has been investigated with any pretence to scientific accuracy. White's notes also contain reference to the following dye-plants: Kakariki is a small creeping plant, rough to the touch, and having a delicate scent. It is bruised into a pulp, and put in the *kumete* with the

* "New Zealand Journal" p. 210. † "New Zealand Journal," p. 214. ‡ "Reminiscences of Twelve Months' Service in New Zealand," p. 162. § "The Southern Districts of New Zealand," p. 314. ‖ "Story of New Zealand," vol. i, p. 19. ¶ John White, author of "Ancient History of the Maori," 1887–88 (MS. in Dominion Museum).

tanekaha-bark to make a good yellow dye. It is also rubbed on the hands with tutu-juice made from tupakihi to give the hands a blood-red appearance; as also in war the young untattooed men mark the faces with a little tutu mixed with the juice of the kakariki to give them a brave and wild look, in imitation of the *moko* (tattoo) of the warrior. Makomako (*Aristotelia racemosa*) yields a bark which is bruised and steeped in water, and used to dye the flax a blue-black. Tuhuhi, which is supposed to be the same as the whakou, maire-tawhake, or whawhakou (*Eugenia maire*), is a swamp-loving tree which produces from bark and young twigs a blue dye. Hangehange (*Geniostoma ligustrifolium*) is a shrub yielding a bark which, pounded into a pulp, was placed in the *kumete* with water to dye flax black. Pokaka (*Elaeocarpus Hookerianus*) was used in the same way as the hinau-bark to make a black colour. Makamaka (*Ackama rosaefolia*) bark was used as a dye to produce a dull red or brown.

Colenso* (1868) states that black dyes were obtained from the bark of the hinau and pokaka, and also from the makomako, and a red dye from the tanekaha or toatoa. Hughes† (1870), in a note on "tutu (*Coriaria ruscifolia*) as a dye wood," relates the following experiment: Some woollen, silk, and linen were boiled for a short time (half an hour to an hour) with some chips (the wood of the tree afterwards treated with a hot solution of copperas—ferrous sulphate). The colours were pure, varying in intensity according to the number of times the material was treated with the decoction of the wood. The dye is superior to that of logwood, inasmuch as it is pure. Woollen materials take it readily and well. Silk is not so readily affected, and linen takes more time. The wood of the tree may be used as a substitute for logwood. Skey, in an editorial note to this paper, considers that the dyeing properties of juices of the tutu-plant are due solely to the abundance of tannin they contain, and are not analogous to the special dye principle of the logwood (*haematoxylin*), for which reason he does not think that it can be used for dyeing any shade to which tan bark is not equally applicable. Smith's‡ (1878) paper enumerates as native trees which contain tannin only the tawhero (synonymous with towai, *Weinmannia racemosa*), whinau or hinau, toatoa, tawai (*Fagus fusca* and *F. Menziesii*), makomako, and yellow kowhai (*Sophora tetraptera*). He states that tannin in the native trees certainly does not abound, but it is made up for by the introduction of the numerous varieties of *Acacia* from Australia, and advocates the cultivation of them extensively in New Zealand. It will be noticed that the *Weinmannia*,

* "Essay on the Botany, Geographic and Economic, of the North Island of the New Zealand Group," Vol. i, Trans. N.Z. Inst. † "On certain Properties of the Tutu-plant. "Trans. N.Z. Inst., Vol. iii, p. 243. ‡ "On certain New Zealand and Australian Barks useful for Tanning Purposes." Trans. N.Z. Inst., Vol. ii, p. 571.

Fagus, and *Sophora* are here in the present paper mentioned for the first time. In the discussion which followed Smith's paper at the Hawke's Bay Philosophical Institute, Colenso related that the *first* use of the barks of New Zealand trees for tanning purposes, which took place at Ngunguru (between Whangarei and the Bay of Islands) in the years 1839, 1840, and 1841, had come under his special notice while living at the Bay of Islands, and often travelling in that district. This was the first place in New Zealand where hides were tanned for leather, and the whole process was particularly primitive. Extracts of these several barks there used, with specimens of the trees producing them, he had sent to Sir W. J. Hooker, the Director of the Royal Gardens at Kew, long before New Zealand became a British colony.

Colenso* (1881) describes the Maori black dyes as being strikingly deep, pure, brilliant, and lasting. All their earlier European visitors were astonished at the intensity of this colour used as a dye among them. For dyeing black their flax (*Phormium*) and their toii (fibre from *Cordyline indivisa*, or giant cabbage-tree) garments he mentions only hinau and pokaka bark used in conjunction with a mordant composed of aluminous clay, also the tutu-shrub, to produce a blue-black. For colouring wood black they used a charring process. Colenso's statement regarding aluminous clay being used as a mordant is interesting as advancing another theory as to the reaction of the hinau decoction in the fibres to be coloured.

Elsdon Best† (1898) says, Two very good and fast dyes were used by the weaving fraternity of the *whare pora*. They were red and black. The black was used for dressed and undressed flax, and its use is still common. The red dye is now but little used, for two reasons: first, the practice of *taniko* is almost obsolete; and, secondly, because the Natives are beginning to use European dyes, which, I take it, is the death-knell of the ancient *whare pora*.

Black dye: For this purpose there are two processes through which the fibre has to pass. It is first soaked in water in which certain barks have been steeped, and afterwards it is placed in a certain black mud. For this black dye the bark of either the hinau, tawai, tawhero, or hinau puka is used. The bark is placed upon a stone and beaten with a wooden mallet of maire wood shaped like a thick pestle until the bark is all bruised and broken up. . . . When thoroughly crushed a portion of the bark is put into a wooden trough hollowed out of a log. A layer of crushed bark is placed in the bottom of the trough, and on this is placed a layer of fibre, then another layer of bark, and so on. The trough is then filled with water and the fibre left to steep in the dye thus formed for twelve or sixteen hours. When taken out the fibre is sticky to the feel and by no means black but of a dirty-brown colour The fibre is then steeped for twenty-four hours in a peculiar black mud such as is found in a white-pine swamp and in which is seen a reddish exudation. Such swamps are famous places and have

* "On the Fine Perception of Colours possessed by the Ancient Maoris." Trans. N.Z. Inst., Vol. xiv, p. 60.

† "The Clothing of the Ancient Maori." Trans. N.Z. Inst., Vol. xxxi, p. 650.

been used for centuries. An example is that at Rakau Whakawhiti-whiti, near Te Umu-roa. This mud renders the fibre a deep black—in fact, it *is* the black dye, while the dark sap of the bark sets the dye of the mud.

Red dye: This was obtained from the bark of the toatoa (or tanekaha). The bark is pounded and broken up. . . . The crushed bark is placed in a vessel, which is then filled with water and placed on the fire, where it is allowed to boil for some time. In ancient times the bark was placed in an *oko* and stone-boiled, but now iron pots are used. After being allowed to boil some time the fibre to be dyed is placed in the vessel, the water in which is now coloured with the red sap of the toatoa-bark. After being boiled for some time a bed of hot white clean ashes is prepared, the fibre taken out and placed in these hot ashes, which are raked over the fibre. A stick is used as a poker to separate the fibre and keep turning and raking it so that every part may come into contact with the hot ashes and yet not be singed, burnt, or discoloured by the heat thereof. This process is to set the dye and prevent it from fading. The fibre is then again boiled in the dye for about ten minutes, after which it is hung up to dry and is then ready for use.

Hamilton* (1899), in the volume dealing with the dress and clothing of the Maori, says that for dyeing the flax black it is soaked in water in which hinau-bark or towai has been placed. The further details are practically those given by Best, but he makes the statement that the colour is a very permanent one, but seems to destroy the flax, as in old mats the black portions fall into dust, the black being much more brittle than the rest of the mat. Hamilton states that to dye flax brown demands more skill and knowledge, and he describes the methods of using tanekaha or toatoa bark previously quoted from Best. He says that a curious old-gold colour is made from the bark of the karamu (*Coprosma*), and a brighter yellow from raurekau (*Coprosma grandifolia*). They also used the bark of the tutu (*Coriaria ruscifolia*) to obtain a blue-black, which was sometimes used for fancy and ornamental work, and in weaving graceful little baskets. It had a very peculiar tint.

Te Rangihiroa† (1911) thus describes the dyeing of the flax-fibre by the Maori:—

Black colour: The prepared, washed unbeaten fibre is used in all cases. The bark of the hinau, tawai, or takou (species uncertain) is pounded and boiled. The boiling in ancient days was done by putting red-hot stones into a *kumete* or vessel containing water, or placing the *kumete* containing the bark and water in a *hangi*. The *kumete* was elevated on a small *whata* or platform to prevent it being scorched. Cold water could be used, but the bark had to be thoroughly pounded and the fibre soaked for a considerable time. . . . The soaking of the fibre is to prepare it for receiving the dye and to fix the colour. The fibre must be thoroughly dry before staining or the stain will not hold. The stain is obtained from certain swamps known as *repo-parapara*. The toi mats and some of the rain-cloaks are trodden into

* "Maori Art," p. 272: "Dress and Clothing of the Maori." † "On the Maori Art of Weaving Cloaks, Capes, and Kilts." Dominion Museum Bulletin No. 3.

the mud, but the fibre for the finer mats was carefully rubbed with handfuls of the mud several times. Without treating with the *waitumu* (*i.e.*, boiling or heating, or steeping with cold water) the stain would not hold. It is now washed and dried, and remains a deep black, which never washes out. Mr. Hamilton mentions in "Maori Art" that the fibre is apt to rot. This is the reason the fibre for good mats is not trodden into the mud, as it would be much more liable to decay. The black fibre is known as *karawai*, and also as *parapara*, from the mud.

Red-brown colour: A red-brown colour was obtained from the bark of the toatoa. The bark is bruised and boiled as with the hinau, and the fibre soaked in the boiling mixture. It is frequently looked at until it reaches the desired colour. The next step is to squeeze out the water and *tawhiu* the fibre in the powdered charcoal of some toa-bark. This deepens the colour. *Tawhiu* is to turn or draw the fibres through the charcoal. In these days the charcoal is prepared by burning the bark in an iron pot. The dyed fibre takes the name of "toa" from the bark. The bark which gives the deepest dye is obtained from the older trees with a thick bark which grow in sunny sites.

Deep-golden colour: The bark of the *Coprosma* gives a deep-golden colour, especially the older shrubs growing in sunny places. The karamu raunui or large-leafed *Coprosma*, known on the East Coast as raurekau (*Coprosma grandifolia*), is the species used for dyeing. The smaller-leaved *Coprosma* or karamu rauriki is not used by the Whanganuis. The bark is boiled as with toa (*Phyllocladus*), but the tawhiu process is not used. This completes the list of Maori colours.

SUMMARY.

From the foregoing we learn that the ancient Maori obtained the vegetable colours he needed to ornament his clothing from the following trees and shrubs:—

Pure-black colours were obtained from the hinau small tree (*Elaeocarpus dentatus*) and the pokaka (*E. Hookerianus*), and to a less extent from the towai or beech trees (*Nothofagus fusca* and *N. Menziesii*), the tawhero-tree (*Weinmannia racemosa* and *W. sylvicola*), and hange-hange-shrub (*Geniostoma ligustrifolium*).

Blue-black colours were got from the tutu or tupakihi shrubs (*Coriaria ruscifolia*) and the mako-shrub (*Aristotelia racemosa*).

Red-brown colours were yielded by the toatoa or tanekaha tree (*Phyllocladus trichomanoides*) and makamaka-shrub (*Ackama rosaefolia*).

Yellow, golden, or brownish-yellow colours were got from the karamu-shrub (*Coprosma* species, probably *C. lucida* or *C. robusta*), raurekau-shrub (*Coprosma grandifolia*), and puriri-tree (*Vitex littoralis*).

A blue colour was said to have been obtained from the whakou-shrub or small tree (*Eugenia maire*).

It is significant that in the majority of cases the colouring of the fibres was effected by the aid of plants which are known to be extremely rich in tannin or closely allied compounds—an aspect which it is hoped to say more about in a subsequent portion of Part I of this article.

(To be continued.)

ROOT-KNOT OF FRUIT-TREES.

IMPORTATION OF AUSTRALIAN TREES PROHIBITED.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

PRACTICALLY every one at all connected with the fruit industry of the Dominion has some knowledge of the controversy which has been carried on more or less continuously for several years relative to the alleged affection of Australian fruit-trees with root-knot disease.

The matter first came prominently under the notice of the officers of the Department in the season of 1912, when it was found that the roots of a percentage of the imported trees were affected with cancerous growths. These growths, together with other characteristic root developments, were on investigation found to be identical in every way with those described by Dr. E. F. Smith and other officers of the United States Department of Agriculture as crown-gall, root-knot, or hairy-root (*Bacterium tumefaciens*).

In the August, 1912, issue of the *Journal* Mr. T. W. Kirk, Director of the Horticulture Division, published a short article illustrated by photographs of affected trees, briefly describing the disease and warning planters against planting trees affected in this manner. A number of the 1912 consignments were condemned, and the trees picked over and the rejected trees destroyed. At that time the New Zealand nurserymen and a large number of orchardists were opposed to the idea of disease, holding that the cancerous growths were due to abnormal callousing as a result of root-grafting; and that the hairy root-growths were nothing more than strongly developed but quite natural growth common to Northern Spy stocks. These contentions were also put forward and have been subsequently maintained by a majority of the Australian nurserymen.

The action adopted by the Department in 1912 apparently had the effect of bringing about a more careful selection of the trees intended for the New Zealand trade, as little further trouble occurred until the 1915 season. Toward the latter end of that season, however, some very badly affected trees came to hand. As a result of this, Mr. Kirk, in February, 1916, communicated with the Commonwealth Government officials and shippers, transmitting a photograph of one of the many objectional trees received, and stating that in future should any trees similarly affected be sent forward the whole consignment of which they formed a part would be condemned and reshipped. A few months later, when the season of 1916 opened, it was found

necessary to take the action indicated, on account of objectionable trees still being packed and sent forward in Australian consignments.

Later consignments, although condemned, were not reshipped, but were held on the request of the shippers for further consideration. It was eventually decided, in order to minimize loss to shippers and disappointment to planters, to allow all condemned consignments for the remainder of the season to be picked over, and all trees showing no sign of the disease to be liberated. A representative of the Victorian Department of Agriculture, Mr. C. C. Brittlebank, Plant Pathologist, visited Wellington, and was present when the above-mentioned temporary settlement was arrived at.

The serious position created in 1916 made it essential on the part of the Department to arrive at some form of settlement of this question. In this connection there were three important points to be decided :—

(1.) Whether the disease affecting the trees was actually *Bacterium tumefaciens*.

(2.) Whether apparently clean trees from an affected source were liable to develop the disease after planting.

(3.) Whether the disease, in the event of it being *Bacterium tumefaciens*, was injurious to fruit-trees.

In order to definitely determine the first point the Minister of Agriculture directed a bacteriological investigation of affected trees to be made. This was carried out at Dunedin by Professor S. T. Champtaloup, of Otago University, assisted by Mr. Brittlebank, and Mr. A. H. Cockayne, Biologist of this Department. Although this investigation was not scientifically conclusive, it was sufficiently so to satisfy the officers of the New Zealand Department that their previous diagnosis of the disease was a correct one.

Before the end of the season an event occurred which to an extent gave an affirmative answer to the second point. A consignment of some six hundred trees, apparently quite clean when imported from Australia the previous season, were found to be badly affected with root-knot after having been grown for twelve months in a New Zealand nursery composed of practically new soil. Throughout last summer reports of similar experiences, together with affected trees, came to hand from different parts of the country.

With reference to the third point, it is impossible at this stage to state definitely whether the disease is detrimental to apple and pear trees or not; but Mr. Kirk, reporting to the Secretary of Agriculture in April last on the whole question of root-knot, appended to his report the following summary, which clearly shows that it would be wiser to treat the disease as detrimental until something more definite has been ascertained :—

1. "Root-knot" is an abnormal growth affecting the root of a tree.

ROOT-KNOT ON FRUIT-TREES IMPORTED FROM AUSTRALIA.

Showing the development of the disease on apparently healthy trees in one season after planting. (See page 66.)
Fig. 1. Pear. Figs. 2 and 3. Apples.

2. "Hairy-root" is held to be due to the same organism as root-knot.

3. New Zealand fruitgrowers are practically unanimous in their opinions against the planting of trees affected with galls.

4. Opinions are divided in respect to the planting of trees affected with hairy-root.

5. Trees from an affected nursery, apparently clean at the time of planting, have been known to develop galls after having been planted twelve months.

6. It has not been definitely proved that root-knot is or is not detrimental to the apple or pear, but it has been proved to be highly detrimental to the peach and raspberry.

7. Knowing the disease to be detrimental to the peach and raspberry, is it wise to risk planting affected pear and apple trees until the effect of the disease on such trees is definitely known?

8. If it is considered unwise to plant affected trees, is it wise to continue planting trees from an affected source when trees from such a source have been known to develop the disease after planting?

In the meantime the question of apparently clean trees from an affected source developing the disease after planting was being further tested. Several thousand apple and pear trees of an Australian consignment condemned last season for root-knot were planted in a local nursery after all the visibly affected trees had been removed. The trees were planted in nursery rows, were carefully tended through the year, and were lifted in June of this year in the presence of Mr. Kirk and myself. The apples on examination were found to have developed the disease to the extent of over 60 per cent., while the proportion of the pears affected was even higher. Photographs of some of the affected trees are reproduced herewith.

This is considered to be a highly important experiment. It definitely refutes the more or less popular contention that the trouble is not a disease but merely a characteristic of the Northern Spy stock, as in this case the pears were even more badly affected than the apples. It also fully confirms the statements contained in paragraph 5 of Mr. Kirk's summary, as well as making it imperative to answer the question contained in paragraph 8.

Therefore, in due consideration of the welfare of the fruit industry of the Dominion, and the serious position that might be created through the planting of trees affected with root-knot, and the manifest impossibility of definitely determining when a tree is not affected, these questions have been answered in the negative, and it was decided to prohibit the further introduction into New Zealand of fruit-trees from the Commonwealth of Australia. The prohibition was effected

TWO OF THE AUSTRALIAN PEAR-TREES WHICH DEVELOPED ROOT-KNOT, SHOWING POOR GROWTH OF AFFECTED TREES.

The roots of tree on left are shown on a larger scale in Fig. 1 of the preceding illustration.

by an Order in Council dated 16th July, 1917, and published in the *Gazette* of 19th July, 1917, the text being as follows:—

WHEREAS by section 4 of the Orchard and Garden Diseases Act, 1908 (hereinafter termed "the said Act"), it is provided that the Governor-General may from time to time, by Order in Council gazetted, prohibit, either absolutely or except in accordance with regulations under the said Act, the introduction into New Zealand, either generally or from any specified colony, country, port, or place, of any plant, fruit, fungus, parasite, insect, or any other thing which in his opinion is likely to introduce any disease into New Zealand:

And whereas hairy-root, crown-gall, or root-knot (*Bacterium tumefaciens*) is a disease within the meaning of the said Act: And whereas, in the opinion of the Governor-General, the introduction of pear, apple, quince, or stone-fruit trees, cuttings, or buds into New Zealand from the Commonwealth of Australia is likely to introduce the said disease into New Zealand:

Now, therefore, His Excellency the Governor-General of the Dominion of New Zealand, in pursuance and exercise of the powers and authorities conferred upon him by the said Act, and acting by and with the advice and consent of the Executive Council of the said Dominion, doth hereby prohibit the introduction into New Zealand of pear, apple, quince, or stone-fruit trees, or of cuttings, buds, or any other portion of any such trees (except the fruit), from the Commonwealth of Australia.

And, in further pursuance and exercise of the powers conferred on him as aforesaid, and acting with the like advice and consent, doth hereby declare that the regulations under the said Act (regarding the importation of fruit or plants into New Zealand) made on the 23rd August, 1915, and published in the *Gazette* of the 2nd September, 1915, shall be modified to the extent herein set forth; and doth also declare that this Order in Council shall come into force on the date of its publication in the *Gazette*.

POISON FOR SMALL BIRDS.

Strychnine-poisoned wheat prepared as follows has been found very effective in combating the small-bird nuisance:—

Put 12 lb. of wheat in a box kept for the purpose, measuring about 18 in. by 12 in. Make about a wineglassful of strong syrup by stirring three tablespoonfuls of sugar into that quantity of warm water. Take 1 oz. of strychnine, and put about a fourth of it at a time into a porcelain mortar (placing the mortar first on a sheet of newspaper in case any may be spilled). Powder it up, and go on similarly with the other three-fourths, emptying each fourth as powdered on to another sheet of paper. It will be found easier to do it this way than to attempt to grind the whole ounce at one time. When it is all powdered, put the empty pestle and mortar into the wheat-box, and rub them well over with some of the wheat to clean off the powder. If a spatula, stick, or bit of tin has been used to scrape the powder out with, clean that with wheat in the same manner. Splash the syrup in small portions at a time over the wheat, and mix up thoroughly with both hands, standing the box all ways to get at the bottom layers, till the wheat is all *just moist* (not wet) and very sticky to the touch. Sift some of the powdered strychnine over the top layer with the spatula or bit of tin, and work with the hands; sift some more, and repeat till it is all in. Rub the paper with the wheat, and set fire to the paper. Then give the lot a good working with the hands. Thoroughly wash the hands and utensils and take every other precaution. The wheat can be scattered in the usual way. (Annual Report of Chemistry Section, 1908.)

HEDGES AND HEDGE-PLANTING.

W. H. TAYLOR, Horticulturist.

THE fact that there are so many species of trees and shrubs that can be, and are, used to form hedges is often a source of embarrassment to intending planters. In some parts of New Zealand almost any species will succeed, but in others the choice is more limited. Among species that are seriously affected by local conditions may be mentioned the golden akeake (*Olearia Forsteri*). This native shrub makes a most excellent hedge in the cooler parts and where the soil is deep and rainfall fairly abundant, but it is a complete failure if subject to dry conditions of soil, particularly if associated with a warm climate. The growth becomes stunted, and a gall insect attacks the young shoots. In similar conditions holly and euonymus, both splendid hedge-plants in favourable situations, are nearly killed by scale insects, the damage being great because growth is poor. Laurestinus in dry conditions becomes a prey to thrips, and Chatham Islands akeake (*Olearia Traversi*) to the borer. Individual taste is, of course, a factor to be reckoned with: some do not care for the yellow foliage of the golden akeake, preferring the darker green of the laurestinus, escallonia, and similar dark-foliaged plants. The purpose for which a hedge is required should also be considered. In some cases it is a wind-screen that is needed, which may be better provided by planting trees of moderate growth, such as the black wattle or *Pinus muricata*, or a compact tree such as the Lombardy poplar. These make lines rather than hedges.

TALL HEDGES.

The cost of trimming hedges has always to be reckoned with, and the taller the hedge grows the more expensive it becomes. The work of trimming hedges from a platform is bound to be slow. It is therefore advisable when proposing to plant for a tall hedge to select a species that will cost as little as possible for its maintenance. No tree can make a good hedge unless it keeps its lower branches. With few exceptions the pines become bare at the bottom after some years, and the same is true of the black wattle. *Cupressus macrocarpa* should, in my opinion, be barred. It is liable to die out at any time, more particularly if it is cut much; if it is not cut it occupies too much space; and trimming a macrocarpa hedge of any height is expensive. There are three trees well adapted to form high hedges that cost comparatively little to trim. *Cupressus torulosa elegans*

(sometimes the middle word is omitted) planted about 4 ft. apart requires no trimming, except maybe a little on the lower branches. The tree will thrive almost anywhere, and appears not to be particular as to soil. The drawback is that for some reason the trees are expensive—probably because there has been little demand for them. *Cupressus Lawsoniana* is probably the hardiest tree we have, and, planted 4 ft. apart, it makes a magnificent tall hedge. Trimming should be done by pruning rather than shearing—that is, cutting out branches to limit its width and leaving the rest alone. The third tree, *Acmena floribunda*, is of a different type, and may be described as a giant myrtle. It should be planted 6 ft. apart to make a tall hedge; trimming is inexpensive, as it is easy to cut. The acmena has long been known in New Zealand as a well-doing handsome tree, but it is only quite recently that nurserymen have offered it in quantity for hedges.

GARDEN HEDGES.

Hedges in a garden are usually required to be kept within comparatively narrow limits. They may be required for subdivision in the garden, as a boundary-hedge outside shelter-trees, or in the case of quite small places the hedge may be the only screen from outside view. The first things to consider are the local condition of the soil and the normal rainfall and climate. In the South Island and the south end of the North Island there is a large choice of varieties. For the more northern districts the choice is more limited, because, as previously indicated, a number of species that make good hedges will not thrive in the warmer climate, where they become a prey to various insect pests.

Three species may be mentioned which do uniformly well in any part of New Zealand — namely, *Eleagnus japonica*, *Cupressus Lawsoniana*, and the privets, of which the common privet (*Ligustrum vulgare*) makes the neatest hedge. These are specially mentioned because they make perfect hedges. The Lawsoniana can be kept to narrow limits, and does as well as when allowed to grow to a larger size.

In addition to these three species the following are also serviceable in northern districts: *Pittosporum tenuifolium*, *P. Colensoi*, *P. eugenioides*, *P. crassifolium*, *P. undulatum*, *Escallonia pterocladon*, *Buddlea globosa*, Osage orange, *Tecoma capensis*, *Ligustrum sinense*, *Berberis vulgaris*.

For other parts of the Dominion all the foregoing list may be used except *Tecoma capensis* and Osage orange, which would not succeed in the coldest places. In addition the following are suitable: *Berberis Darwinii*, *Coprosma Baueriana*, *Escallonia macrantha*, *Euonymus japonica*, holly, yew, laurestinus (giant), *Olearia Forsteri*, *Olearia macrodonta*, laurel (common), *Rhamnus alaternus* (buckthorn).

Buckthorn I consider the best of all for a hedge of moderate size, but none of the nurserymen appear to stock it, which is a great pity. The plants are easily raised from seed, and the seed is freely produced. Some years ago I planted a hedge of it, and young plants sprang up in large numbers alongside the hedge. All the plants mentioned are capable of forming good hedges, provided they have suitable conditions. Those specified in the last list require fairly good soil and a fair rainfall; most of them would fail under very dry conditions.

Eleagnus requires to be planted in a double line, as a hedge of it planted in a single row will blow over. For this reason, and as it cannot be kept very narrow, it is not suitable for planting in small places. The common privet is the best of all plants for making a low and narrow hedge; this opinion is strengthened by personal observations in many parts of the Dominion. It is said that privet is very exhausting to the soil, and it certainly has that drawback, being a surface rooter; but the exhaustion to the soil is naturally comparative to the size of the hedge, and if growth is restricted to narrow limits the value of the hedge compensates for any loss in the soil.

Preparing the Site.—No hedge can really thrive unless the roots have a good run. A narrow trench dug in hard soil does not provide this condition, yet frequently nothing more is possible. In such cases the surface should always be kept clean and well worked, and if surface digging can be extended some distance it will assist the plants, particularly by enabling rain to enter more freely. When trenching be sure to keep the original surface soil on top. In gardens the whole area should be trenched.

Planting.—Eleagnus, *Tecoma capensis*, and Osage orange should be planted in double lines, 9 in. or 10 in. apart, and 2 ft. 6 in. apart in each row. All other species may be planted in single line, common privet 10 in. apart, and other plants from 12 in. to 15 in. As to the time for planting, my own experience is that, on the whole, spring-time is the best season, giving better results than autumn planting.

Trimming.—A common mistake is to cut the tops irrespective of the habit of the plant. This makes the hedge slower in reaching a given height; there is no compensating advantage in many cases, and it causes the hedge to broaden more than is desired. *Olearia Forsteri*, holly, and the various pittosporums do not require topping until several years after planting. Eleagnus has a habit of making a number of long thin growths. Those that come out at right angles from the line of the hedge should be cut back, but those on the top should be knotted together; if the ends of two shoots are brought together from opposite directions it will be found they can be wound round each other so as to form a knot, and they will retain that position. The effect will be to greatly strengthen the hedge and hasten

its upward progress. Trimming should not be too severe during the first year of a hedge, as growth makes corresponding roots. In after-years trimming can be done at any time the state of growth requires it; the time of cutting does not affect the tree.

FARM HEDGES, ETC.

In the foregoing matter the subject has been treated mainly from the horticultural or homestead aspect. Where hedges of considerable extent are required, and it is desired that they should keep in live-stock or be proof against intruders, I consider that barberry (*Berberis vulgaris*) or the cherry-plum (*Prunus myrobalana*) are the best plants to use. Eleagnus would have the desired effect, but the cost of trimming it is considerable. The cherry-plum can be raised from cuttings. The plants should be set in double rows 9 in. or 10 in. apart, and the plants 30 in. apart in each row. In the winter following planting the plants should be all cut down to within 6 in. of the ground; or if growth has not been good delay the cutting-down for a year. As a result of the cutting-down the plants will each throw up a number of very strong shoots, which make the foundation of a hedge proof against cattle. Barberry should be planted in the same way—namely, in double rows, and at the same distances. On good soil barberry will make an impenetrable hedge, though not so strong as the cherry-plum.

African boxthorn (*Lycium horridum*) makes a most excellent hedge that appears to be very hardy and capable of withstanding salt-laden gales from the sea. It has, however, the disadvantage that its very strong and sharp thorns are poisonous, and it thus contains a considerable element of danger to man and beast on the farm. In a number of cases boxthorn hedges have been cut out on this account. If, however, it is thought worth while to face these drawbacks, and also the further danger of the plant being spread by birds carrying the seed, it can be depended on to make a formidable hedge. Hawthorn under New Zealand conditions has too many disadvantages for it to be recommended as a hedge-plant.

Tagasaste (*Cytisus proliferus*) is frequently used with good effect to provide quick shelter, a role it fills very well. It was not included in the foregoing list of hedge-plants, as it does not form an ideal hedge.

It is reported that an arrangement has been made between the Governments of the United States and Canada whereby all farm labour necessary for the harvest would be collected in Kansas in July and gradually moved northwards and distributed by the two Governments in co-operation, thus making good the deficiency in men in Canada resulting from the war.

EXTERNAL PARASITES OF SHEEP.

ERADICATION OF TICKS IN NEW ZEALAND.

Paper read by Mr. ALFRED MATTHEWS, Waiorongomai, Featherston, at the Annual Conference of the New Zealand Council of Agriculture, July, 1917.

THE question of the eradication of ticks on sheep is a very difficult one to deal with, and there is certain to be a great difference of opinion in connection with my views on this matter, which are the result of over fifty years' experience. I think it will be necessary to take you back to the early history of our flocks in New Zealand, when they were largely infected with scab and that disease caused so much loss and worry to the sheep-farmers of that period. Want of information relative to the habits of the insect, and primitive appliances, caused the early settlers in many cases to struggle on for years before effecting a cure.

I first had to deal with a scabby flock of over eight thousand merino sheep when I was under twenty years of age. I had not seen the disease before. I knew nothing about dipping; in fact, I had never seen a dip, nor did I know where to go to see one. I visited some settlers I knew to try and glean some information, but each one gave different advice, and the Sheep Inspector did not assist me much. One old friend advised me to start shearing at once, and to stand by and rub my hand over each sheep as it was shorn, and when I felt a spot to at once scarify it with the point of my knife, and then apply some tobacco-water to it, which I must keep handy in a bottle—rather a tedious process with the number of sheep I had to deal with. Another friend consoled me by stating that as the run was very rough, and bounded by a mountain-range swarming with wild sheep and no fences, I had a work of years before me.

Some time after I was in Wellington and saw in a bookseller's window a small pamphlet called "Scab and Its Cure," by Alexander Bruce, Chief Stock Inspector of New South Wales. As the disease was originally brought from that country to New Zealand, and as for many years scab had existed there, I thought the pamphlet worth obtaining. I purchased it for 1s. 9d., and I have often stated that the information it supplied saved my father at least £2,000. By following instructions I was enabled to effect an absolute cure, and when the Inspector granted a clean certificate he stated that one other settler only had been equally successful.

The dipping-mixture then used was made up of tobacco and sulphur, but later on lime and sulphur, a much cheaper dip, came into use and proved very effective. The Sheep Act was very stringent; progressive fines were imposed, and in some cases the Inspector took charge of a settler's flock and cleaned it at the owner's expense. Some of the Inspectors were experienced and capable men, and better able to deal with a scabby flock than many of the sheep-farmers. Although when scab first broke out fencing was expensive, wire fencing being almost unknown, the country extremely rough, with numerous wild sheep in places, and sheep generally very difficult to muster, the disease was eventually stamped out, and there has been no return of it. Sheep-farmers are now in quite a different position from those early settlers who had to contend with scab, and should find no difficulty in eradicating ticks, as they now have proper appliances for dipping. The country has been largely cleared of bush and scrub, is divided and subdivided with good fences, and, except on some of our mountainous country, there is no difficulty in mustering the sheep.

The tick (*Melophagus ovinus*), or ked as it is termed in England, is not a troublesome parasite to destroy, as it is unable to live for more than from four to six days off the animal under favourable conditions. It does not lay eggs, but its young are brought forth as pupæ, which are attached to the wool fibres and develop in about twenty-one days. Although it is an easy matter to destroy ticks with one dipping, it may be necessary, in order to exterminate the pupæ, if the right time is not selected for the work, to give a second dipping. At present the Stock Act allows sheep-farmers in the North Island the months of January, February, and March, and in the South Island February, March, and April, in which to dip their sheep; and if the season is dry and there is a shortage of water the Inspector has power to extend the period to any one applying for an extension of time. The result is that one sheep-farmer will perhaps dip early in January, and his neighbour may not do so until late in April or May, and with only wire fences, and not always secure ones, between the two flocks, you cannot expect dipping on such lines to be successful. In January last year my son purchased some lambs from a neighbour, and saw them dipped before he brought them away. The man had just dipped the rest of the flock in the same careful manner in which the lambs were treated, yet at shearing-time not a single tick was found on the lambs purchased, but the flock from which they were obtained was badly infested; and this could only be attributed to the careless system of dipping adopted by his neighbour and carrying out the work late in the year.

I consider that the time allowed for dipping should not exceed six weeks, and the period should extend from 1st January to about the middle of February — a time when there is seldom the same scarcity of water that there is later on. Many will say that at that busy time of the year the work of dipping could not be attended to. Dipping is as essential at that time of year as nearly any other class of work, and you can do a lot of it in a very short time if you wish, and I am quite certain if you extend the present period there will be a number of our sheep-farmers who will not find time to dip until near the end of the term allowed. I have for many years dipped shortly after shearing, and I am now quite convinced that it is the right time to carry out the work, as, although I never dip more than once during the year, my flock for some time has been absolutely free from ticks or lice. My sons, who own parts of my old property, and dip about the same time, have also clean flocks.

If dipping is carried out shortly after shearing, especially if lambs are shorn at the same time as the rest of the flock, there will only be the live ticks (and few of them) to deal with, as the pupæ cannot well adhere to the short wool of machine-shorn sheep. I do not think ticks increase to any extent during the very hot part of the year, as they appear to be in a semi-dormant condition, similar to the acari of scab, which appeared to make no progress during that period of the season, but spread over the sheep very rapidly when the autumn rains set in. I have never found late dipping satisfactory, as you have not only a greater number of ticks to destroy, which seem particularly active at that time, but also a very large proportion of pupæ, some of which will escape; and if heavy rain follows dipping the sheep will then soon be infested as before. Late dipping is much more costly, is not as effective, and is of little use as regards the fly trouble, which would be the only benefit from dipping if ticks and lice were exterminated.

If sheep are clean dipping is unnecessary, except for the fly, or perhaps to prepare sheep for show purposes or for sale; but it does not in any way assist the growth of wool, for if a flock is properly cared for Nature provides all that is necessary to promote wool-growth.

The present Stock Act will not assist in the eradication of ticks. It deals to some extent with lice, and if infested sheep are found in any public place the owner can be summoned and fined; and a sheep-farmer can be compelled to dip his flock if an Inspector finds it to be infested with ticks, which does not often happen. Section 48 of the Stock Act states that if an Inspector is satisfied that any sheep in a flock are infested with lice or ticks he may give notice to dip, but if sheep are to be slaughtered or are fit for that purpose

he may postpone the notice for fourteen days. This reads as though the sheep can be driven to be slaughtered for any distance in an infested condition. If the owner refuses, neglects, or fails to comply with the notice he is liable on conviction to a fine not exceeding £50; and if after such conviction his sheep are not immediately dipped to the satisfaction of the Inspector a further fine of £50 can be imposed; and so on for each conviction. I believe this section is rarely, if ever, enforced. Under section 51 an Inspector cannot compel an owner to dip immediately before or just after lambing.

There is no supervision by Inspectors in connection with dipping, and, with the large number of flocks we now have in New Zealand, it would be too costly a matter to bring about. When scab existed the Inspector was expected under the Act to inspect each flock at least once every year. To do so now in our large districts would be a severe task for any Inspector, especially with the large amount of office-work he has to contend with. Undoubtedly, dipping in many cases is carried out in a very careless manner. I have heard of instances when the supply of dip ran out in the middle of the work; but that did not trouble the owners of the sheep, as they added water until the dipping was completed. Careless mustering also interferes with successful dipping, and on hilly country, especially if the work is left until late in the season, there will often be a number of weak lambs unable to travel to the yards. The constant movement of sheep to and from saleyards in the autumn causes trouble to the careful sheep-farmer, as weakly sheep sometimes knock up, and drovers occasionally lift them over the fence into the nearest paddock, hoping to recover them later on; and in many cases these are undipped sheep.

Every sheep-farmer should have a dip on his property if he wishes to dip effectively. The owner of a small flock does not require a long, expensive dip, but a short one or a small round dip will meet his requirements, provided he keeps each sheep a sufficient time in the bath; and for small lots of purchased sheep it saves expense. I cured eight thousand scabby sheep in a dip only 9 ft. long on the top and 4 ft. 6 in. wide, and my present dip is only 25 ft. long.

In my opinion, ticks and lice should be stamped out absolutely throughout the Dominion. We cured our flocks of scab many years ago under very great difficulties, and there has been no return of the disease; and if we dealt as effectively with ticks and lice we should have no further trouble with those pests. Old settlers often expressed the opinion that poverty-stricken sheep produced scab. If that were the case we should have it with us at the present time, as there are always some miserable sheep in all flocks. The same argument is often used now in connection with tick and lice; you

are told that poverty produces the pests, as poor sheep are always more infested than fat ones, and this is certainly the case. The poor sheep do not produce these parasites, but prove a congenial breeding-ground. A sheep-farmer a short time ago told me quite seriously that he was sure that ticks were transformed into flying insects, and quitted the sheep at a certain time during the year. Perhaps wings carry some of them off in a certain way, as when the fleece becomes long in early summer ticks are found on the outer extremities of the wool, and then starlings have a good time. Spontaneous generation of insect-life is out of the question, and if our flocks were once cleared of ticks no return need be feared, unless they come from imported sheep, which can be easily prevented.

Most of the poisonous dips give satisfactory results if used carefully, but some of the directions for use are rather ridiculous, as they allow a different strength for lambs, long-woolled sheep, and merinos. Surely, if a weaker mixture will kill ticks on lambs it will also kill them on grown sheep. Non-poisonous dips are not satisfactory; I found when I used them many years ago that my flock always suffered to some extent from ticks and lice.

I am perfectly aware that all I have stated in this paper will be quite useless as far as the eradication of ticks is concerned unless our Stock Act is amended and similar sections to those formerly dealing with scab brought into operation in connection with ticks—which is hardly likely to take place. If dipping could be confined to a short period soon after shearing it would mitigate the evil considerably, but if all our sheepowners were compelled to dip carefully during that time I am quite sure that ticks would soon be eradicated. We, however, know well that a number of our sheepowners will not exercise sufficient care, either in mustering or dipping, and unless compulsion is exercised we cannot hope to stamp out this curse to our flocks. The same apathy exists in England relative to scab, where it has existed for centuries. In the last report I saw it was stated that there had been one hundred outbreaks there in excess of those of the previous year; and this occurs in a country where there should be no difficulty in effecting a complete cure of the disease in a very short time.

In conclusion, I may state that I have had to deal with my flock under nearly all the conditions that sheep are likely to go through. I have had them swarming with lice, with considerable loss of wool; I have had their wool almost a chocolate colour through ticks, and consequently impaired in value. But I then dipped at any time during the season when it suited me, and chiefly with non-poisonous dips. Eventually I used a good poisonous dip shortly after shearing. Lice at once disappeared, and I have not seen one for many years

past; and ticks soon followed. Dipping is costing us a lot of money every year, with not sufficient result, as we only to a certain extent check the increase of the pests, but under the present system will never eradicate them. In this paper I am expected to deal with ticks only, but I have brought in lice to some extent as well, especially as I believe that the treatment suggested for the one will apply to the other. I know many of you will not agree with my views on this subject, but they are the convictions of one who has taken a practical part in the management of his flock for the greater part of his life and has been fairly observant and successful.

NOTE.—We have pleasure in printing Mr. Matthews's interesting and suggestive paper. It may be mentioned that the Department consistently advocates—both through its field officers and in print—early and repeated dipping. See, for instance, the article on "Sheep-dipping," by Mr. J. L. Bruce, in the *Journal* for November, 1915; also New Series Bulletin, No. 64, September, 1916. Steady pressure is also brought to bear to enforce the law as it stands.—EDITOR.

CERTIFICATE-OF-RECORD COWS.

META.

A daughter of Commodore de Kol, bred and owned by Mr. G. Aitchison Kaitangata. C.O.R. at 4 years 24 days: 675·06 lb. butter-fat in 346 days. Leader of the Junior Four-year-old Friesian Class.

KILLING AND PLUCKING OF POULTRY.

F. C. BROWN, Chief Poultry Instructor.

WHILE there are many different methods of killing fowls, the most common is by dislocation of the neck. Providing this is properly carried out it is undoubtedly the most expeditious method, and gives the bird the minimum of pain. The usual way of performing this operation, by holding the head in the hand and swinging the bird round and round until the neck is broken, is a most cruel practice. The best and simplest method is as follows: Hold the bird firmly by the legs in the left hand, at the same time grasping the wing-feathers in the same hand so as to prevent the bird from struggling; next take the head between the first and second fingers of the right hand, and bend it backwards as far as possible; then draw the neck downward, and by a sharp but not too strong a pull the neck is dislocated close to the head, when death immediately takes place.

Immediately the neck is broken the plucking should commence, as the warmer the bird the more easily will the feathers come out, and the less risk is there of tearing the skin. Muscular action will take place for a short time, but if the operation is properly done practically no pain is suffered. This is obvious for the reason that the brain, which is the base of all feeling, is severed from the body, except as regards the skin surrounding the neck. Where it is not desired to pluck the bird as soon as it is dead it should be allowed to become quite cold before the plucking is commenced, as a half-cold bird is much more difficult to pluck than one that is either hot or extremely cold.

In plucking a bird the operator should sit down on a seat about 20 in. high, a box of the same height being placed at the right-hand side to catch the feathers. The bird's head should be allowed to hang downwards, so that the blood will run to the neck, otherwise the blood is apt to remain in the body and give the carcase a dark appearance. Care must be taken that the legs and the wings are held firmly in the left hand until the bird has practically finished struggling, as their movements are apt to interfere with the work of plucking.

The tail-feathers are the first to be pulled. These are firmly grasped in the right hand and slightly twisted, and with a sharp pull they are torn out with the one movement. The feathers on the

1. DISLOCATING THE NECK.

2. PLUCKING THE TAIL-FEATHERS WITH ONE MOVEMENT.

3. COMMENCING TO PLUCK THE BACK.

4. STRIPPING THE BREAST AND SIDES.

5. PLUCKING THE ABDOMEN.

6. REMOVING THE FLIGHT-FEATHERS WITH ONE PULL.

back are next pulled. If these are taken between the thumb and forefinger of the right hand and pulled downward they will come out quite easily. After cleaning the back the bird is turned round, the breast and sides being treated in a similar manner. As the breast is the most tender part of the bird, it is necessary to properly clean this as soon as possible, as the skin is apt to be torn in the plucking process if the bird is allowed to become half cold, especially in the case of very young birds. When the breast and sides have been completely plucked, the under-part surrounding the abdomen should

7. THE OPERATION COMPLETED.

be stripped. The wing-feathers in turn may then be taken. The whole of these are gathered in the right hand, and with a sharp pull towards the head they are entirely drawn out. In plucking the legs the bird is held straight upwards, taking one shank at a time in the left hand. The forefinger and thumb are closed tightly round the hock-joint and run sharply down the thigh. This will bring out the bulk of the feathers, the others being plucked in the usual way.

Of course, there is a knack in pulling feathers properly which can only be gained by experience. When plucking a fowl the bulk of the feathers should be drawn the reverse way to that in which they

lie upon the body. A common custom is to dip the bird in boiling water before plucking. This method has much to recommend it, especially where the bird has been dead for some hours, or if it is hurriedly wanted for cooking purposes. For marketing, however, scalding has the effect of giving the carcase a soft appearance, which often reduces its value for market purposes. Birds should be fasted for at least twelve hours before killing; the carcase will then keep longer.

The accompanying photographs, which were taken to illustrate these notes, will help to make clear the methods described.

BROWN-ROT OF FRUIT.

INVESTIGATIONS IN HAWKE'S BAY.

G. ESAM, Orchard Instructor, Hastings.

Of the many pests and diseases now attacking fruits and fruit-trees in New Zealand perhaps the most destructive is brown-rot. The past season certainly showed the seriousness of the disease in stone-fruit orchards. It caused heavy losses of fruit in Hawke's Bay, and Auckland suffered even worse. Noting the serious headway the disease made in December last year, the writer spent several days with stone-fruit growers investigating the extent of infection, the preventive measures adopted, and the results. At the same time Mr. W. C. Morris, Agricultural Instructor to the Hawke's Bay Education Board, at Hastings, conducted inoculation experiments which he has been good enough to allow me to include in this article. I propose to show how closely Mr. Morris's experiments coincide with my own investigations of the most successful methods of control, but before describing the experiments a simple outline of the life-history of the disease will be given.

LIFE-HISTORY OF THE DISEASE.

To the ordinary observer the disease first attracts attention on ripening fruits. It appears on matured stone-fruits as small, brown, circular spots, which rapidly increase in size, causing the whole of the fleshy part of the fruit to turn brown. As the spots increase in size small tufts of mould, resembling the blue mould of bread, rise on the surface. On the top of this mould

are the fruiting-spores of the fungus, which are also known as the summer spores. Some of these spores are dispersed by natural agencies such as wind, others are carried by insects. Under certain conditions these spores germinate, one essential condition being the presence of moisture: this may either be ordinary atmospheric moisture or moisture from the fruit itself. Very often the disease first appears on fruits which are touching—moisture being held for a considerable time at the point of contact of two fruits. After germination—that is, the rising of a new shoot or growth from the spore—it enters the fruit and therein multiplies in a very remarkable manner, feeding on the plant-food. Small circular patches of decay have been observed in just over twenty-four hours, and the whole fruit will decay in three to four days. As the disease spreads in the fruit fresh summer spores are thrown out on the surface. It is recorded that these summer spores can be produced under favourable conditions in thirty hours from the time of the spore entering the fruit. With the spread of the disease on the fruit the flesh turns a characteristic brown colour; but the flesh does not become sunken until the larger portion of the fruit becomes diseased. Some of these infected fruits fall on the ground, others remain attached to the tree. The flesh ultimately shrivels and dries up, the fruit becoming mummified.

Although it is considered by scientists generally that the disease is carried over winter on mummified fruit, and that it is highly important that diseased fruit should be destroyed, it is held that the disease also winters in the wood of young shoots. That these diseased shoots or twigs are even more dangerous as a source of infection is evident from their position in close contact with other parts of the tree and with the fruit. To secure control of the disease it is absolutely necessary that all such diseased wood should be removed.

On mummified fruit two kinds of spores are produced—(1) semi-dormant spores, or oospores; (2) dormant or winter spores, or ascospores. Summer spores may also be present, but I think it is a generally recognized fact that active spores may and do become dormant or semi-dormant spores when unfavourable conditions prevail, such as when the plant or fruit which is attacked dies. It is claimed that the winter spores, or ascospores, will remain dormant on mummified fruit in the ground for two winters and then germinate. However, in the spring these spores germinate, producing fresh spores, which are liberated by various agencies. These spring spores settle on buds, flower-petals, young leaves and twigs, and even young freshly formed fruits. If the weather conditions are suitable they germinate and enter the parts mentioned. The fungus grows in them and causes the affected parts

to turn brown and die. It also causes shrivelling, decay, and dropping of small green fruits. Summer spores are produced on these affected parts. Blossoms affected by the fungus remain attached to the twigs for the greater part of the summer, and hence, as indicated, twigs can also be a medium of carrying the disease from one season to the next.

In the Hawke's Bay District last season early peaches and nectarines suffered most damage, and Japanese plums were also badly attacked. Cherries, English plums, and quinces also suffered, and apples to a much less extent. The disease was at its worst following the week of wet, hot weather at Christmas-time. Again, early in March when the same atmospheric conditions prevailed it threatened to treat some of the late peaches in a like manner.

INOCULATION EXPERIMENTS.

The following is a brief account of Mr. Morris's investigations, carried out in January and February of this year. The first part of the experiment was conducted to test the time of the development of the fungus from spore to spore. Firm but nearly ripe peaches were picked from a tree and inoculated with a sterile needle in three places with summer spores taken from a freshly picked infected peach. Twelve hours later spots of a dirty, dark colour were showing about $\frac{1}{8}$ in. outwards from the points of inoculation. In twenty-four hours the places spread to $\frac{1}{2}$ in. in diameter, and in thirty-six hours the infection had doubled in size, but no summer spores were showing on the surface. By the end of forty-eight hours summer spores were produced, and the fruit was almost wholly rotten, and in sixty hours it was quite bad. This experiment was conducted outdoors, and demonstrates the rapid spread of the disease, taking only thirty-six to forty-eight hours from the time it first enters the fruit until it again produces another batch of spores to carry on further infection.

In Mr. Morris's second series of experiments different kinds of fruits were inoculated with two classes of spores. One kind was the same as that used in the preceding experiment, taken from a freshly infected peach the tissues of which had not collapsed. The other was of oospores, or semi-dormant spores, taken from a peach which had fallen a week or longer, the flesh being almost shrivelled up. In the first test of the series fruits of the following kinds were inoculated with both the foregoing classes of spores, a sterile needle being used: Matured but green pears, firm plums, green grapes, tomatoes turning colour, green beans, matured but green nectarines and peaches. Both kinds of spores took, and set up decay, on all except the beans. The summer spores taken from the freshly infected fruit set up decay sooner than the

oospores, or semi-dormant spores, taken from the shrivelled peach. With the former spores the fruits were rotten in two to three days, while the latter spores took three to five days to set up similar decay. This test clearly shows that no matter what kind of spores enters the fruit rot will be set up, and that even green fruit will go bad.

In a further test the same two kinds of spores were utilized, but instead of a sterile needle being used for inoculation the clean fruit was rubbed against the infected fruit, care being taken not to wound the tissues of the sound fruit. After ten days no result was noticed on any of the kinds of fruits rubbed. This points to the conclusion that rubbing without injuring the tissues does not set up rot, and, further, the combined results of the two tests indicate that some injury—either by insects, such as flies, or other agent—must first be done. Smooth-skinned nectarines also gave a negative result by rubbing. I am inclined to suggest that the totally negative results of the last experiment may possibly be due to the absence of moisture, the fruit being dry when the spores were rubbed on.

LOCAL ORCHARD INVESTIGATIONS.

Early in January this year Hawke's Bay growers complained of the large amount of fruit which had rotted in transit. The fruit was apparently quite sound when packed, the usual degree of ripeness as in former years being maintained when picking. The two large companies in the district received daily the same disastrous reports about the early stone-fruits they handled and despatched. Retailers would not buy in quantity, with the result that prices declined very considerably, even for fruit which was sound when it reached its destination. The two companies supplied me with the names of their best suppliers in relation only to freedom from brown-rot. I interviewed these and many other growers as to the precise method they had adopted to control the disease. My inquiries were principally confined to summer control. One orchard only was free from disease; it contained peaches and pip-fruits but no plums. The peaches were sprayed three times with lime-sulphur solution, 1–130, the first time just after the fruit had set, and two later sprayings, the last one two or three weeks before picking. All fallen fruit in this orchard was gathered up regularly and destroyed by burying. This orchard had brown-rot the previous year. Within a stone's-throw of this orchard another grower sprayed Cardinal nectarines four times with lime-sulphur, but with negative result, all going bad in transit. This grower also lost heavily in early peaches. No fallen fruit was gathered up in this orchard. Three other orchards were nearly free from disease, under 5 per cent. of fruit being lost. One of them has quite a number of plums, but no Burbanks.

No summer spraying was done in these orchards, but all fallen fruit was gathered up at regular intervals and destroyed. In another orchard which was nearly free from disease no summer spraying was done, but all rejected fruit at picking-time was immediately destroyed. Eight other orchardists who had sprayed with lime-sulphur in the summer from one to three times, but who had not gathered the fallen fruits, had more or less negative results. These growers did not appear to be in any better position than those growers who had done nothing to control the trouble. This investigation suggests that by destroying fallen and infected fruit loss from infection by brown-rot is minimized.

In badly infected orchards the presence of flies on infected fruits was most noticeable — in fact, under one affected tree I estimated that flies were feeding on 75 per cent. of the infected fruit. I formed the opinion, rightly or wrongly, that flies were the main carriers of the disease when puncturing the skin with their beaks to secure the sugary sap or juice. This assumption is also borne out by Mr. Morris's experiments. In these, it will have been noted, infection readily took place when the skin was punctured. Professor H. B. Kirk, of Victoria University College, Wellington, an authority on flies, was good enough to supply some information in reply to a query as to whether flies would puncture the skin of mature and ripening peaches, nectarines, and plums, and thereby infect the fruit. He states, "The biting stable-fly will, in the laboratory, penetrate the wall of bananas, grapes, and pears, and probably also of the fruits you mention. I have not observed it in the open, but should expect it to occur. The same applies to mosquitoes. But, as you know, many other insects will injure fruits, as will birds. To a wound so caused non-biting flies may carry infection from diseased fruit on which they have settled. Blow-flies, house-flies, and the fruit-fly are all well equipped for this purpose and frequent fruit in orchard or shop."

The later peaches and nectarines appear to have a slightly thicker and tougher skin than the earlier varieties. This might possibly be the reason why the later fruits are not nearly so badly attacked, as flies and other insects would certainly be better able to puncture the skin of the thinner-skinned earlier varieties. Norton states that most of the infection takes place through wounds caused by various means, and claims that on peaches all the disease follows insect-bites or other injury. As stated when dealing with the life-history, other authorities are of the opinion that spores germinate on and enter the skin.

SUGGESTIONS FOR CONTROL.

The foregoing knowledge of the life-history of the disease, coupled with Mr. Morris's experiments and my own investigations,

has led me to suggest the following lines of preventive treatment. Commence in the dormant season by picking off the trees all shrivelled and mummified fruit; cut off and burn all dead twigs; and gather up and burn all prunings and mummified fruit, including stones. This winter work is important in that it destroys most of the mediums by which the disease is carried from one season to another. To catch and destroy the spring spores, spray with a fungicide just as the buds show pink. In the Hawke's Bay District all growers spray for leaf-curl, so that operation will serve the double purpose. Of the four orchards mentioned as being practically free from brown-rot, two were sprayed at this stage with lime-sulphur and two with bordeaux —personally I prefer the latter.

Now comes a debatable point — that of summer control. In this the following three points are worthy of the most earnest attention of growers—namely, thinning of fruit, degree of ripeness when picking, and destruction of fallen fruit. Thin judiciously by leaving good spaces between the fruits, allowing no fruits to touch. The point of contact of two fruits is very often where the disease first makes its appearance. In regard to picking, the riper a fruit is up to a certain stage the more subject it is to brown-rot. This knowledge is helpful. If brown-rot is feared, pick the fruit on the green side, yet sufficiently matured to ripen properly. Avoid as much as possible picking and packing the fruit when wet, also wipe the hands after touching infected fruit, so as not to carry spores on to clean fruits. Gather up and destroy all fallen fruit, allowing nothing at any stage to rot on the ground. This will prevent infection being carried by flies and other insects.

Summer control by spraying is admittedly a phase we know very little about at present. Quite a lot of spraying has been done with more or less indifferent results. I think summer spraying coupled with the destruction of fallen fruit the best means of control. I am inclined to favour atomic sulphur, with lime-sulphur next. To me there seem to be two very important periods of application—namely, immediately the fruit has set, and again a fortnight or so before picking. I would also recommend one or two intermediate applications. A Henderson (Auckland) grower has stated that he had excellent results with atomic sulphur combined with arsenate of lead. The latter evidently acted against leaf-roller and other biting-insects, preventing wounds by which the fungus enters the fruit. The Horticultural Division at Arataki Station and in certain Henderson orchards is carrying out very extensive spraying experiments, the results of which, no doubt, will give us a more definite line of control for succeeding seasons.

STACKING AND THATCHING DEMONSTRATION.

THE rural art of stacking and thatching is one which, unfortunately, has tended to disappear in New Zealand of late years. Poor work of this class is frequently seen on the farms, resulting in the waste of valuable material which has been stacked. Some years ago stack-builders in various districts used to compete against each other by stacking on farms in their districts, and awards were made by experienced judges in connection with agricultural societies. Valuable prizes were given by the Feilding Agricultural and Pastoral Association, among others, for these competitions. Unfortunately, however, the latter

THE STACKING AND THATCHING DEMONSTRATION AT PALMERSTON NORTH SHOW.

were gradually discontinued. Instruction in stacking and thatching forms part of the training of the student-assistants at the Weraroa Central Development Farm, and in order to arouse interest in the subject it was arranged that the students should give a demonstration with miniature stacks at the Palmerston North Winter Show held in June. The demonstration was successfully carried out in the Wheeler Memorial Pavilion, eighteen students competing against each other in pairs. The work was judged by Mr. J. Balsillie, of Kairanga, points being allotted for stacking, thatching, uniformity, and finish. Six certificates of merit were awarded. The arrangements were in charge of Mr. W. Dibble, of the Central Development Farm staff, who is acting as instructor to the students in these branches of farming.

LAND-DRAINAGE.

SOME NOTES ON OPEN DRAINING.

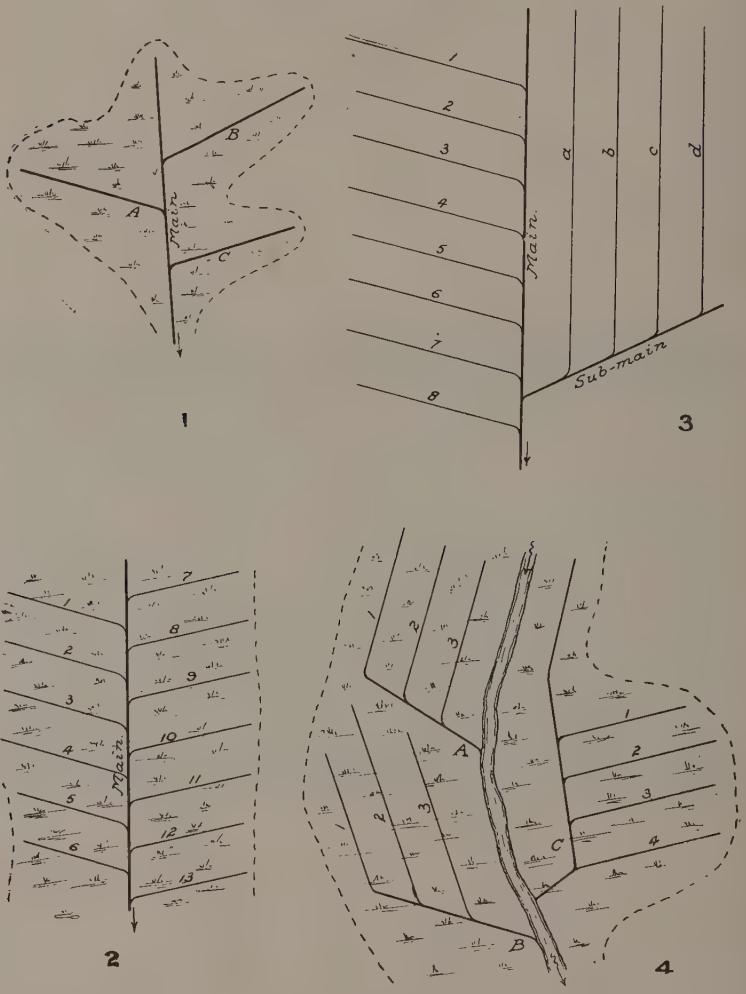
L. J. B. GRANT, Fields Inspector, Tauranga.

WHEN increased crop-production or stock-carrying capacity on wet or swamp lands is aimed at, drainage naturally becomes the first consideration for removing the surplus water. Open channels, whether natural streams or artificial ditches, receive water that passes through the soil as well as the water that flows over the surface of the ground. In ground composed largely of sand, or soil with a gravel subsoil, effective and sufficient drainage can be accomplished by open channels. The open nature of the soil permits free percolation of water, first from the surface, then into the gravel, and thence into the channels. But in a heavy loam or clay open channels afford less effective drainage, owing to the slow percolation of water through the soil, and the walls of the ditch becoming puddled, thus impeding the passage of water into it.

Tiled drains and underdrains are better than open-ditch drains, but are quite impracticable on swamp country of a peaty formation, such as that around Te Puke and extending to Otamarakau, also the Rangitaiki Swamp. On such land shrinkage takes place when the water is drained off, and open-ditch draining must be resorted to until the ground becomes sufficiently consolidated to permit tile drainage.

Main outlets being cut, draining the farm section can be taken in hand. It will be advisable to keep in mind certain cardinal principles which, although simple, are important in the construction of drains. The drain should be located where nature would provide the natural watercourse, for the obvious reason that the surface slope of land leads the water in that direction, and the soil will naturally permit the flow of water towards lower ground. Cut the drain in a straight line as far as possible. Any change in direction should be made in long curves, avoiding as far as possible carrying the ditch through where no drainage is required. This is where one may have to depart from the rule of placing the drain where nature would have placed it. Straightening by short cuts here and there makes the method less expensive (and perhaps more effective) without impairing its value as a drain compared with a natural course. The subdrain should follow the line of drainage as far as possible, and laterals in a line of

the greatest slope. There may be exceptions to this principle, but they apply to particular cases when it is necessary to intercept water which percolates through the soil from a high level.



DRAINAGE-SYSTEMS.

(See p. 93.) [*Diagrams by L. J. B. Grant.*

Experience shows that deep drains and fewer of them are better than smaller ones and more of them when tapping the source of water-supply, such as main springs. Under other con-

ditions, however, the land can be made dry too quickly, causing crevices, and thus interfering with capillary action. This may make the land as valueless as when too wet. A gradual draining of water should be aimed at.

The accompanying diagrams illustrate different systems of drainage designed for various natural conditions.

Fig. 1 indicates the plan upon which all drainage-systems should be based, and is in itself sufficient for draining small areas. The main drain is dug along the line of lowest levels of the swamp, and the side drains A, B, C are dug along the principal gullies or most suitable points where they will drain the largest possible area.

Fig. 2.—This system may be used alone to drain an elongated strip of swamp, or as an extension of the system in Fig. 1. The main is to be dug along the line of the lowest level (the natural watercourse), and the laterals 1 to 13 almost at right angles to the main—that is, along the greatest slope.

Fig. 3.—This is perhaps the most economical system for draining very flat lands. By adopting a similar method the laterals 1 to 8 and *a* to *d* can be graded sufficiently where the ground would be too flat for any other system.

Fig. 4.—By this very useful system a number of laterals are run into a short main, and discharged through a single outlet. This system can easily be extended by using it in conjunction with that shown in Fig. 3.

POINTS IN PIPE DRAINING.

A. J. FAULKNER, "Wairakaia," Gisborne.

THE writer having put down about five miles or more of pipe drains on "Wairakaia" and observed a good deal of draining elsewhere, the following notes may perhaps be of some assistance or interest to readers of the *Journal*.

It may be asked, does pipe draining pay in wet, sour land, and is the average farmer justified in going to the expense of it? My experience has been that pipe draining does pay, and it pays so well that in most cases the farmer gets the total cost of the work back in about three years (in less time if the land is being cropped) by the sweetening and increased carrying-capacity of his land. The money spent brings in a higher interest than any bank can offer.

The following are points to be remembered in pipe draining land of the nature here dealt with:—

1. Drain across the fall—not with the fall.

2. In Poverty Bay 3 ft. to 4 ft. is the most satisfactory depth to put pipes down.

PIPE DRAIN LAID AT "WAIRAKAIA."

(See particulars on opposite page.)

3. The laying of bundles of manuka on the ledge in ditch above pipes is labour well spent. (Ledge is shown in photo.)

4. Four-inch pipes are more satisfactory than 3 in.

5. The greater the length of drain the more friction in the pipes. Therefore in a 20-chain (or over) drain, which has to carry a great deal of water, start with 3 in., say one-third of the way, and finish with 4 in. the other two-thirds. I prefer, myself, to start with 4 in. and finish with 5 in.; or, if possible, use 4 in. with two outlets.

6. It is better to drain in winter, when the ground is wet. A sighting-level is always useful—in fact, necessary. I use a 12 in. (No. 7) level made by John Rabone and Sons, which cost 5s. 6d. With water in the ground for additional guidance, this instrument is quite accurate enough for most purposes.

7. It is easy to mark out the necessary part to drain when the paddock is being cropped, but hard to mark out when in grass; and the more the farmer watches and studies the nature and best treatment of his land the better.

8. In peaty land, which keeps on sinking more or less, and which therefore will not carry pipes, a 12 in. by 1 in. matai board laid on the ledge in ditch will be found satisfactory.

9. Every inch of rain means some hundred tons of water per acre, and the quicker the surplus water is taken off the land the better. Therefore one should think twice before using 3 in. pipes or under.

The accompanying photo shows a pipe drain recently laid at "Wairakaia," the length being 20½ chains and average depth 3 ft. 6 in. The cost was as follows, all labour being at the rate of 10s. per day: Digging, 25 days, £12 10s.; cutting and carting manuka, 7 days, £3 10s.; putting pipes on line, 1½ days, 15s.; laying pipes in drain, 1½ days, 15s.; filling in drain, 10 days, £5; cartage, 1,350 pipes, £5; price of pipes, 1,350 at 16s. per 100, £10 16s.—total, £38 6s.

The ground through which the drain was cut is composed of 9 in. to 12 in. of black soil, underlaid by papa formation with small pumice layers here and there. The pumice layers carry the water to a greater or lesser extent, and for this reason I like to have the drains not under 3 ft. 6 in. deep, as I find this not only drains the ground above the pipe-line but also drains off the water which otherwise would run down and soak the lower levels.

NOTE.—Mr. Faulkner is the owner of Wairakaia Station, one of the oldest properties in the Gisborne district. Although a married man with four children, he has heard the call and recently enlisted as a gunner in the 31st N.Z. Field Artillery.—EDITOR.

A FUNGOID DISEASE ATTACKING PEARS.

I. W. HELMSING, Orchard Instructor, Auckland.

PEARS suffered badly in the Auckland District during the past season. An exceptionally light set was followed by weather conditions which were anything but conducive to an average standard of quality being attained. Codlin-moth claimed a lamentable toll, and fungoid diseases were exceptionally prevalent owing to the dull and humid weather prevailing. Of these latter, the pear-scab (*Venturia pyrina*) is quite familiar, but another disease which is not so well known, named *Entomosporium maculatum*, is apparently very much on the increase. Resembling pear-scab to a marked degree, it is more often than not confounded with the latter, but if careful examination be made the two diseases may be easily distinguished.

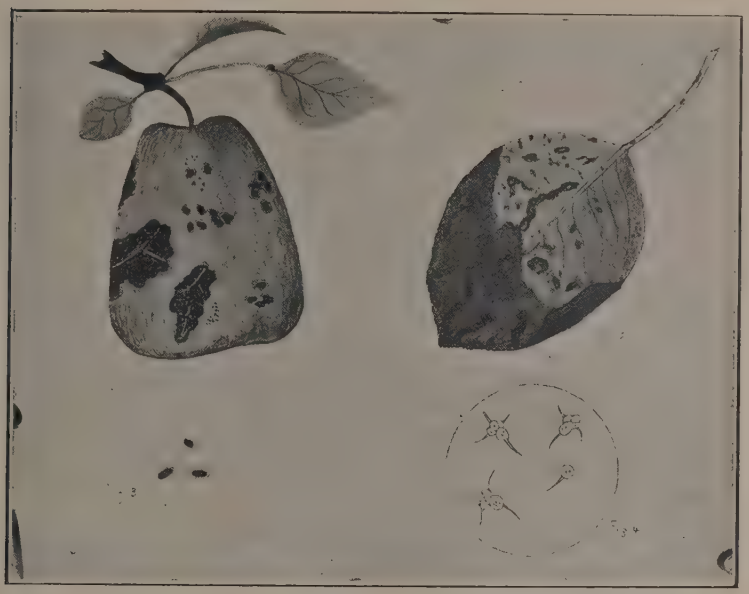
When the fruit is attacked by the disease now referred to the flesh often cracks in the same manner as when attacked by scab. The spots are at first brown, resembling fly-specks, hard and slightly sunken. These, gradually increasing in size, become surrounded by a reddish-coloured ring (more especially on the sunny side of the fruit), and minute black pustules of conidia appear in the centre. In some instances, by individual spots joining together, large areas of the fruit are involved; these areas become in most cases surrounded by a red margin. The attack commences with the bursting of the buds, and the same characteristic spots may be found upon the young leaves as they unfold, and where the attack is severe these turn yellow and brown and fall off. The fruit may be attacked when quite small. Later in the season the leaf-stalk will be found covered with brown to black spots surrounded with the red ring, and the leaves turn yellow and brown and fall prematurely. Dense masses of conidia are produced upon the dying leaves, the pustules being surrounded by green and red margins.

The conidia of the fungus are formed by two superposed cells, with two or more cells growing from the middle septum, all the cells terminating in fine hairs.

The varieties specially noted as being subject to attack are Beurre Diel, Williams, Clairgeau, Fertility, and Le Lectier; but more cannot be said at present with regard to the resisting properties of the varieties.

Nursery stock suffers badly when attacked, the constant falling-off of the foliage and the resultant production of a further crop of leaves to replace the diseased ones taxing the strength of the young tree and stunting its growth.

The disease also attacks the peach, quince, and other trees belonging to the Rosaceæ.



PEAR (FERTILITY) ATTACKED BY ENTOMOSPORIUM MACULATUM.

Fig. 1. Fruit affected. Fig. 2. Leaf and leaf-stalk attacked. Fig. 3. Spots on fruit enlarged. Fig. 4. Conidia highly magnified.

The treatment advised is as follows: All dead diseased leaves should be burnt or buried, and the trees sprayed with bordeaux. An autumn spraying of bordeaux while the leaves are still hanging is strongly recommended. It would be well to pay special attention to the spring spraying as the buds are bursting, the same spraying also serving for black-spot control.

The foliage of the ngaio-tree is harmful to live-stock if eaten in large quantities.

BLACK-SPOT OF APPLES.

W. H. TAYLOR, Horticulturist.

THE "black-spot" disease of apples is commonly known in scientific nomenclature as *Fusicladium dentriticum*, but that is really the conidial or summer form of *Venturia inequalis*. It is important that both forms of the disease should be understood, as the effective control of the Fusicladium form is to a very great extent dependent on the destruction of the Venturia or winter form of the disease. Intelligent pruning and timely spraying must go hand-in-hand or there cannot be effective control of the disease. Fungoid pests are most troublesome in wet seasons because that condition fosters their growth. It therefore happens that measures that were apparently quite successful one season fail to control the disease in a season when there is more rain, dry weather in the former case having acted as an auxiliary force against the disease. We cannot predict the weather, so we should prepare for the worst, even if it entails a little more expense. As a matter of fact it does not do so; all that is required is to act promptly at the proper time and do the work thoroughly.

VENTURIA INEQUALIS.

Young shoots are the chief points of attack; the infection takes place during summer, and the disease winters in the shoots. More rarely it attacks older branches, entering through wounds or insect-punctures. Young shoots are attacked because their bark is tender and easily pierced. The disease first shows as dark-coloured patches. If at this time a strip of bark were cut off, the wood would be seen to be discoloured. Eventually the bark becomes ruptured and torn, or completely thrown off, the ruptures being particularly noticeable at the base of the shoots. In early spring the diseased shoots are easily distinguished. At this time the blackish patches are densely covered with the conidia of the second form known as *Fusicladium dentriticum*. The conidia are carried by wind and rain on to the young leaves and blossom-stalks. On the leaves the disease first appears in the form of small, roundish, dark-coloured spots, mostly on the upper surface. The spots soon increase in size and run into each other, forming large irregular-shaped blackish-olive blotches. At first the mycelium spreads in the leaf under the skin, which is eventually

ruptured, exposing numerous Fusicladium conidia, similar to those on the shoots. The conidia formed on the leaves, also from the shoots, are in turn conveyed to the young fruit, which becomes infected, and the result is "apple-scab." As previously stated, the disease also attacks the stalks of the blossoms, its effect being to disable them and cause the fall of the young fruit.

CONTROL MEASURES.

It is of the utmost importance to remove as far as possible all sources of infection. These include diseased shoots, dead leaves, and mummified fruit, on all of which the disease winters. When it is recognized that the disease cannot be killed by spraying during winter, and that it attacks young leaves as soon as they unfold and frequently blossom-stalks immediately the cluster bud opens, there should be no need to emphasize the importance of cutting off and burning diseased shoots and burying dead leaves in order to prevent the spread of conidia from them to the trees. The reason why winter spraying is ineffectual is because at that time the disease is under the bark of shoots or between the tissues of leaves. This at once explains why spraying may be without apparent effect in checking the disease during summer. The disease quickly gains entrance beneath the rind of the fruit or the skin of the leaves, where the fungicide cannot reach it. It is evident that in order to attain perfect control of the disease it is absolutely necessary to apply the fungicide before the disease penetrates the skin of the leaf or the rind of the fruit. The case may be stated thus: The means of prevention are easy and sure, but to effect a cure is extremely difficult, if not impossible.

The first spray should be bordeaux, 8-6-40, applied just before the buds burst. The second should be half the latter strength, and be applied when most of the cluster buds have opened but before the flowers expand—when, in fact, they are in the state spoken of as "showing pink." The third spray should be given when most, but not all, of the petals have fallen; but owing to the danger of scorching the tender skin of the young fruit the formula should be reduced to 2-3-40, or slightly below the ordinary summer strength. In a normal season little further spraying will be required, but more should be given at discretion if the season be a wet one. The copper-sulphate mixture (bordeaux) is undoubtedly a more effectual fungicide than lime-sulphur, but owing to the russeting effect it has on the fruit, particularly some of the more tender-skinned varieties, its use in the orchard in the summer should be restricted as much as the exigencies of the season will allow, substituting lime-sulphur at the ratio of 1 part to 100 or 120 of water.

BLACK-SPOT OF PEARS.

This is known as *Venturia pirina*, but, although the name is different, there is practically no difference between this disease and that affecting apples. The sequence of development on twigs, leaves, and fruit is the same. Cracking of the fruit is caused by the disease hardening the skin, which ceases growing, and the cracking is caused by internal pressure of the developing fruit. Cracking is more prevalent in pears than in apples, but this is due to the physiology of the fruit, not to the effects of the disease. The treatment required is the same as for apples.

Peanuts.—Messrs. King Bros., Papakura, write that without any previous experience or knowledge they planted last season a few peanuts in a small patch, and had an excellent return, the nuts clustering thickly to the roots. The nuts were sweet and crisp. Their place is on the shores of Manukau Harbour, where the climate is mild.

The Minister of Customs has granted general permission for the exportation of New Zealand hemp to the United States of America. No application or permit will be required while the general permission is in force, but a declaration of ultimate destination must be produced to the Collector of Customs before shipment.

The English Board of Agriculture has made arrangements with the leading banks for lending money to farmers on a Government guarantee for the purchase of seeds and manures for growing wheat, oats, and potatoes. When the grant of credit is approved by the County Committee the applicant will be able to order the seeds or manures, and the bill will be paid through a bank on the applicant signing a promissory note undertaking to repay the amount within nine months with interest at the rate of 5 per cent. per annum.

HAYMAKING IN WESTLAND.

Two crops off 11 acres near Greymouth. See *Journal*, July, 1917, page 37.

WORK FOR THE COMING MONTH.

THE ORCHARD.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

SEPTEMBER might be termed the "washing-up" month in the orchard: that is to say, there are often many little jobs to complete that really belong to the dormant season, such as the completion of pruning, oil-spraying of pip-fruits, planting, &c. All these things can still be done if attended to early enough in the month. It is, of course, an advantage to have all work rightly belonging to the dormant season completed as early as possible, but as regards this year no doubt the exceptionally bad weather that has prevailed in most districts for some time past will have resulted in many branches of work being considerably behindhand. Naturally, the only thing to do in the circumstances is to utilize every minute of suitable weather in pushing along, as it is quite sufficient to have the seasonable work of the month to cope with without having more or less of that of the previous one to deal with at the same time.

When the season is a normal one the work in the orchard during the month is extremely important. Many varieties of plums and peaches are already in bloom, while the remainder are rapidly approaching that stage. The buds of pip-fruits are commencing to move, and before the end of the month many of these will have passed through two spraying-stages. When the trees begin to grow, and blossoms and leaves appear, fungus diseases also become active and change from their winter to their summer form. Thus the best and most reliable time for their control has arrived.

SPRAYING.

Spraying will have already commenced with the early-blooming varieties of stone-fruits for the control of such fungoid diseases as curl, brown-rot, &c. This will, of course, be continued throughout the month, until all the varieties of these classes of fruits have been dealt with. The winter formula of bordeaux (8-6-40) is the most reliable spray for this purpose, but, owing to the scarcity of copper sulphate, lime-sulphur (1–15) may be substituted. In all cases, however, where attacks of brown-rot are to be expected the bordeaux should be adhered to if sufficient of the materials is at all available.

BLACK-SPOT.

In the case of apples and pears the greatest consideration at this stage is the control of black-spot. Recommendations for the control

of this disease were given to some extent last month, but the question is such an important one to growers of pip-fruits, particularly when the climatic conditions are favourable to the spread of the disease, that some further remarks will not be out of place. At the same time it may be pointed out that practically the same precautions are necessary for brown-rot. Destroy all old leaves and mummified fruit as thoroughly as possible by either raking up and burning or ploughing under before the blossoms appear, as it is on such material that the disease largely passes the winter. It also winters on dead and diseased wood on the tree; therefore all such should be carefully pruned away and destroyed. The tree should also be otherwise well pruned, and kept open and well ventilated.

The first application of a fungicide should be made when the buds are well advanced. If applied too soon the winter spores, which resist the spray, will not be sufficiently advanced for the best results to be obtained; if too late, the mixture, which should be at winter strength, might do damage to the bursting buds. The next application, which should be reduced to spring strength (6-4-50 bordeaux or 1–20 lime-sulphur for pears, and 3-4-40 bordeaux or 1–25 to 1–30 lime-sulphur for apples), should be applied after the cluster buds appear and show colour. The next spraying should be given when the fruit has set. Owing to the tender skin of the young fruit being susceptible to scorching at this stage the mixture should be further reduced, and for the same reason the arsenate of lead should be applied at a weaker strength than later in the season. The strength of the combined spray for this application should be 2-3-40 bordeaux with 1 lb. of paste arsenate added, or 1–125 lime-sulphur with $2\frac{1}{2}$ lb. of paste arsenate added. Subsequent sprayings for black-spot will be dealt with in the next month's *Journal*.

BROWN-ROT.

It is unnecessary for me to write anything further on this disease at present, as an excellent article on the subject by Mr. G. Esam, Orchard Instructor for Hawke's Bay, is published elsewhere in this issue of the *Journal*.

CULTIVATION.

Thorough cultivation of the orchard during the spring of the year is highly important. This work should be done, if possible, before the blossoms appear, in order to turn under the old fungus-affected soil, leaves, &c., before the season is too far advanced. This largely depends on climatic conditions, but if it cannot be done at the present time it had better be left until after the fruit has set and a thorough fungicide has been given to the trees—always, of course, bearing in mind the necessity of having cultivation completed before the hot weather sets in, otherwise a considerable loss of soil-moisture from evaporation may be expected.

PLANTING.

The adverse weather conditions will no doubt have had a bad effect on orchard planting. This work, however, may be carried on successfully throughout the month, but naturally it is inadvisable to prolong it any more than is absolutely necessary.

GRAFTING.

Grafting affords the orchardist an opportunity of changing the variety of his fruit-trees more expeditiously than would be the case if he were to replant. The work is very simple, and can be successfully done at any time after the bark is found to lift freely from the wood. There are several different styles of grafting, but the one commonly employed for reworking aged trees is the rind-graft. Prior to reworking, a tree should be headed back to some extent, and when the time arrives for the actual work to be performed the limbs are recut to the required height, and they will then be full of sap and in the proper condition for working. Scions of the variety required should be taken while they are quite dormant, and placed in moist sand in a dark place away from the wind to prevent them shrivelling. The scions should be slightly thicker than a lead-pencil, and should contain three buds, two above the stock when inserted and one slightly below. Taper the scion to a feather edge with a clean sloping cut of about 1½ in., then slightly square off one side of this cut. Cut the stock off square or sloping slightly towards the point where the scion is to be inserted. Slit the bark and raise one side only; insert the scion, and bring the squared edge tight up to the unraised bark. Tie up with waxed cloth or raffia, and seal with grafting-wax in such a way as to prevent the entry of air and moisture. Various methods of grafting, including the rind-graft, were described and illustrated in the *Journal* of September, 1915 and 1916.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

INCUBATION.

On all up-to-date plants September is one of the busiest months of the year, for it is then that the bulk of the chickens must be incubated if they are to have sufficient stamina to withstand the heat of summer and make satisfactory development by the time the dear-egg season arrives. To those who use artificial means for hatching, the question of securing the desired number of chickens at the right time is a simple matter. On the other hand, where the natural mother has to be depended upon probably more trouble will be experienced than ever before in securing the necessary broody hens. Even with the heavier breeds the object of the successful breeder is to eliminate as far as possible the broody propensity from his fowls, and the more this is reached the harder it is to obtain setting-hens, especially at the time they are most required. The up-to-date poultryman realizes that if eggs are to be produced in the greatest number it will not pay him to have birds which will go broody just because they are required for the hatching of chicks. The one and only solution of the problem is the adoption of artificial methods. The difficulties of working an incubator are often exaggerated. Practically any one with the ordinary amount of intelligence can make at least a fair success of the work. Of course, in order to obtain the

best results a reliable make of machine must be used. There are dozens of different makes of incubators on the market, some of which are reliable but others not. Before purchasing an incubator the beginner would be well advised to consult a man of experience, not only with a view to securing a good make of machine, but also to be given a practical lesson on its working. This is not to say that the manufacturer's instructions should be departed from, but rather that a practical demonstration be given as to the right way of applying them.

Temperature, Ventilation, and Moisture.

With so many different styles of machines, and such a variation in the methods of providing the necessary temperature, ventilation, and moisture, it is impossible to lay down any general rule that will suit all alike. There are certain rules, however, which will apply to all kinds of incubators, and the observance of which is essential to success. The most important is that prescribing the maintenance of an even temperature—102° F. for the first week, 103° for the second and third weeks, and 104° to 105° when hatching. The temperature should be taken at the level of the tops of the eggs on the tray; in other words, the bulb of the thermometer should be resting on a fertile egg.

Moisture and ventilation are important factors in the management of incubators. There can be no set rule as to how and when these should be applied that will suit all machines and climates alike. Climatic conditions have a considerable influence in artificial hatching, and these must be studied and the system of management amended accordingly. As a general rule, if the air-cell dries down in accordance with the diagram supplied with the usual book of instructions it may be taken for granted that the desired ventilation and moisture are being obtained. The determination of the correct amount of ventilation and moisture required can only be decided by an experienced operator when examining the air-cell. It is sometimes stated that the size of the air-cell gives no guide whatever to successful incubation or to the correct amount of ventilation and moisture required. Neither it does, unless the operator thoroughly understands it. It is usually advised that when the air-cell is considered to be too small at any given time the ventilators should be opened wider, and if the cell be larger the opposite course should be taken, or the ventilation reduced. This rule, however, does not always work out right in actual practice. For instance, sometimes it may be observed that the air-cell is slow in coming down, but this does not necessarily mean that the egg contains too much moisture. This condition may be solely due to the chicken growing too fast and its normal size practically filling the shell.

The trouble of "dead in shell" at about the pipping-stage is undoubtedly the most vexed problem that the poultryman has to solve. The condition of the breeding-stock is very often responsible for heavy losses in this respect. Instances could, however, be multiplied where the breeding-stock have been in the pink of condition, and yet a very high percentage of the chicks died in the shell when fully developed. Usually on breaking such eggs it will be observed that the chicken is so large that it cannot make the necessary movement to break the shell, and is consequently unable to get out of its prison. The management of the air-cell is thus seen to be a matter

of vital importance, for upon the operator knowing whether an egg contains an excess of moisture or whether it holds an abnormal-sized chick depends largely the success or otherwise of the incubation process.

When it is found on testing the eggs that the air-cell is too small, and the eggs appear to be more or less clear just under the line of the air-cell, this usually indicates that an excess of moisture is present and that the ventilators should be opened wide to allow it to escape. On the other hand, if the cell is considered to be too small and the egg appears to be dark right up to the membrane dividing the air-cell it indicates that the chick is growing too fast, and will probably be too large at the pipping-stage for it to be able to give its natural turn to break the shell. When this condition is observed it goes to show that too much oxygen is being supplied, which causes the chick to grow at too rapid a rate. To prevent this the only safeguard is to reduce the ventilation-space. In some climates in order to have the air-cell down to the desired line the vents have to be kept nearly closed right up to the time of pipping. Of course, just before the eggs commence to pip, and until the hatch is cleaned up, the ventilators should be opened wider, as fresh air is an essential at this stage of the incubation process.

Naturally there are other things to be observed indicating a probable reason for the failure of eggs to hatch. Sometimes sufficient moisture has not been present in the machine, and the membrane (or skin on the inside of the shell) is so tough that the chick cannot pierce it, and consequently dies. This is also a common cause of crippled chicks being hatched. Through the chick being too long in the shell, and the constant working to get out, the delicate legs are injured. Even where chicks fail to hatch it will frequently be found on close examination that the hock-joints are in a more or less inflamed condition through no other cause.

Care of the Lamp.

This is a matter of great importance, not only in regard to securing a good hatch, but in minimizing the risk of fire. Scores of incubators have been burnt, as well as buildings, all for the want of giving the lamp careful attention. Provided the lamp is properly looked after, there is no more danger of it getting on fire than any ordinary house-lamp. It should be filled, trimmed, and cleaned each morning after turning the eggs, and when the machine has risen to its normal temperature. Do not turn the flame up high enough to smoke, or soot will collect in the flue. Never use a wick which does not properly fit the burner, or difficulty will be experienced in maintaining an even temperature. The lamp should be filled on hatching-day as on other days.

Turning and Cooling the Eggs.

After the eggs have been in the incubator for forty-eight hours they should be turned twice a day. The object of turning the eggs is to change their relative position, so as to prevent the germ from sticking against the shell. It is not necessary that the eggs be given a complete half-turn. A few extra rolls will do more good than harm. The eggs should be moved gently for the first few days, so as not to

injure the embryo. It is always a good plan to have a regular time for turning the eggs both morning and night. Cease turning as soon as the eggs commence to pip.

On each day after the third the eggs should be cooled while turning them. It is not possible to give the exact amount of cooling required, as the operator will have to be guided by the development of the air-cell. The longer the cooling under ordinary conditions the larger the air-cell becomes. As a general rule, ten minutes once a day for the first week is sufficient. The time may be increased gradually (according to climatic conditions) up to twenty minutes in the second week, and up to thirty minutes during the third week.

Hatching Out.

If the eggs were fresh when placed in the incubator, and the proper temperature has been maintained, the eggs should pip on the twentieth day, and be cleaned up on the twenty-first day. On no account open the door of the incubator after the eggs have begun to pip. The chicks should not be removed from the incubator until the twenty-second day.

THE APIARY.

E. A. EARP, Apiary Instructor.

BREEDING.

WITH the advent of September colonies in a normal condition should have a good quantity of sealed brood. If, however, the absence of brood is noted the indications point to a poor queen or that the hive is queenless. To attempt to carry such colonies through the spring months will lead to serious trouble, as they stand in danger of getting robbed out. It is a far better plan to unite such colonies than run the risk of disturbing the whole apiary. A simple method of disposing of weak and queenless hives is to unite them with strong ones, and this may be carried out by placing a sheet of newspaper over a strong colony and putting the hive to be united on the top of the paper. In the course of a day or two the hive may be examined to see that the colonies have united. Should the paper be intact it must be torn in several places, when it will be found in the course of a few days that the colonies are working peaceably. It is essential that breeding should be kept steadily going, so that the colonies will be strong in young bees to take advantage of the first flow of nectar. Food and warmth are important factors in inducing breeding, and these must have the constant attention of the beekeeper during the spring months.

FOOD-SUPPLY.

The spring is the most critical period of the year for the beekeeper, and the success or otherwise of the season's work will depend almost entirely upon his efforts to guard against the losses attendant upon starvation. Large losses occur annually through neglect in this

direction. When breeding is in full swing a considerable amount of food is used up daily for feeding the brood, and, unless the weather conditions are favourable to enable the bees to work the early spring blossoms, it is essential that the food-supply be augmented. The amount of nectar gathered when the weather is favourable in conjunction with their stores will tide the bees over long periods, but if bad weather follows, colonies will often be reduced to a state of starvation before the owner is aware of their condition. If on examination a colony is found with insufficient stores to meet requirements preparation should be made to feed at once. It is not a safe policy to keep a colony at starvation-point, as this will prevent the rearing of a succession of young bees to take the place of the rapidly dwindling number of workers at this period.

There are many feeders on the market which can be utilized for the purpose of supplying food. The division-board feeder is the best to use at this season, as it will serve the double purpose of feeder and division-board in cases where the colony is not strong enough to occupy all the frames in the hive. When making an examination of a hive to note its condition the feeder should be placed in the hive in readiness if it is anticipated that artificial feeding will have to be resorted to at a later period. All feeding should be carried on within the hives. Especially guard against feeding at the entrances, as that source will surely produce trouble. Place the feeder on the warm side of the hive, and in cases where the clusters are small the feeder can be inserted in position next to the cluster.

A point to remember in connection with feeding is that it creates an artificial flow and is stimulating, and, when started, it must be carried on until a natural flow from the fields sets in. If there is a suspicion of disease in the apiary, do not attempt to feed honey. In any case it is not wise to use honey taken from another hive, as it is impossible to be sure of its source. Feed only the best white sugar. It is a good plan to feed in the evening, as the discovery of the syrup excites the bees, and the colony has time to settle down before the morning, and there is less likelihood of the other colonies learning the cause of the excitement. A syrup composed of 2 parts of water to 1 of sugar, fed slightly warm, will prove the best artificial food for bees in the spring.

OVERHAULING THE HIVES.

Advantage may be taken of the mild spring days to subject the hives to a thorough overhaul. Where necessary, each hive should be given a good coat of paint. The bottom-board should be cleansed by removing the cappings, dead bees, and pollen, which matter, if left, becomes very objectionable and acts as a harbour for insects. In districts where the bees bring in quantities of propolis it is advisable to remove this also, as it prevents to some extent a rapid manipulation of the frames. In the spring the propolis is brittle and can be readily removed. The operation of cleaning the bottom-board can be facilitated by providing a spare bottom-board. Lift the hive on to the spare board, scrape the dirty one thoroughly, and replace the hive. All weeds and long grass must be cleaned from the hives; they act as a harbour for insects, and keep the bottom-boards damp, besides preventing the bees from flying freely to and from the hives.

ROBBING.

Every precaution must be taken to prevent robbing getting a start in the apiary. Robbing may be caused by exposing combs too long when manipulating the hives, by careless feeding, and by the presence of weak and queenless colonies. These latter should not be tolerated, and the other causes can be obviated by care and attention. On no account should combs be exposed for long intervals, and if feeding has to be undertaken it should be deferred until late in the day. The excitement caused by feeding attracts others, and once they have tasted of the forbidden sweets they will continue to molest the hives for many days. As soon as robbing is detected it is by far the best plan to postpone all operations in the apiary, and the entrances to the hives should be contracted at once. If a colony is in danger of being robbed it may be saved by piling wet grass in front of the entrance. Robbers are less likely to enter a hive so protected. Very little trouble, however, will be experienced by robbing if it is not allowed to get a start; prevention is the best plan in all cases. On no account spill syrup near the hives; do not leave combs lying about; and try and avoid weak and queenless colonies. One will then not be troubled with robbing.

DISEASE.

At each examination a strict watch must be kept for symptoms of disease. If it is present, do not fail to mark colonies for treatment. Mild cases can be treated at a later period in the season, but if a colony is badly affected it is by far the safest plan to sulphur the bees and remove the combs to a place of safety. These combs can be converted into wax when a sufficient number warrant the undertaking. If isolated capped cells are discovered, these should be treated as suspicious. Healthy brood-cells are convex in form, bright in appearance, and in contrast differ greatly from diseased cells. These latter are slightly darker, concave in form, and are frequently perforated. Diseased cells of last season's production are usually so shrunken in appearance as to be easily detected, whether they are in isolated positions or surrounded by healthy brood.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

POTATOES for the main crop should in most places be planted during September, and in the North Island they should be in the ground before the middle of the month. In many parts dry weather sets in early, and unless growth is well advanced before the soil becomes dry a good crop is not likely to be obtained. There may be some risk of damage from late frost, but it is better to accept the risk. When artificial manure is used it should be applied in a way that will enable the roots of the plants to reach it. If it is broadcast much of it will be lost to the plants through the moulding-up. If drills are opened for the sets the manure should be strewn in the drills; it is immaterial

whether it be applied before the sets are in or after. If the sets are planted with a hoe the fertilizer should be strewn, before planting, along the line where they are to go. A portion will then be hoed in with the sets, and the remainder will be in a position where the roots will reach it. Applied in this way, with rows 30 in. apart, and allowing 2 oz. per square yard, $3\frac{1}{4}$ lb. will be sufficient for a row 50 yards long—a trifle over 1 oz. per lineal yard.

Sweet-corn, which is a maize highly prized as a vegetable in America, might with advantage be more extensively cultivated in this country, where it grows to perfection. The sweet-corns are not such large-growing plants as the ordinary maize, and therefore require less space. The plants may stand about 10 in. apart, in rows 30 in. apart. Sow thinly in drills, as for peas, and thin the plants. The time for sowing depends on local conditions—in warm districts about the middle of September, and a month or six weeks later in colder districts. Any fairly good soil will grow sweet-corn without special manuring. A number of varieties are obtainable, including Country Gentleman, Early Crosby, and Early Fordhook, which are tried sorts.

General current work includes sowing peas, French and butter beans, turnip, lettuce, and radish. Lettuce should now be sown in lines, and the plants thinned instead of transplanting. Radishes should be sown in small lots about twice each month; the long varieties are best for summer use, and of these none is better than Icicle, a white variety of extra large size and tenderness. Cabbage lettuces are more satisfactory than the cos varieties. About the middle of September sow brussels sprouts, broccoli (several sorts—early, mid-season, and late), Savoy cabbage, leeks, and cauliflower. Leeks are to be sown in rows for transplanting. Cauliflower sown may include an early, such as Snowball or Early Paris, and, more particularly, a later kind, such as Veitch's Autumn Giant, Sutton's Autumn Mammoth, or Mont Blanc. Capsicum and chili may be sown under glass, to be pricked out in boxes before finally planting in the open ground.

Celery for the main crop should be sown; this may also be regarded as the last sowing of the season. In places that are not too hot the seed may be sown in the open ground. In such case the plants are to be allowed to attain some size before they are lifted and planted in nurse-beds to strengthen before being planted in trenches. Celeriac is not much grown in this country, which is a pity, for it is a very palatable and wholesome vegetable. The cultivation is the same as for celery, except that it should not be planted in trenches and does not require moulding up. The stem just above the roots swells out in a similar way to kohl-rabi, and that is the part that is cooked. It may be used as a dish or in soups. When sowing celery-seed in the open ground be sure to scatter the seed thinly.

Cabbage and cauliflower may be planted, also lettuce, various herbs, and rhubarb. The planting of the latter should be no longer delayed, as the crowns are starting.

SMALL FRUITS.

Everything should by now be in a state of readiness for the season's work, but, if not, do not delay the work of cleaning-up, &c., any longer. Strawberries should be coming into flower; if there are any weeds the beds should be cleaned at once. It is not desirable to disturb the soil

to any depth, as new roots are being made. Mulching is advisable for the protection of the fruit and also to conserve moisture. Spent hops make an excellent mulch; where there is a brewery within reach this material can be usually had for the carting-away. It is best to spread the hops in a shallow heap, and let air and rain act on them for a few weeks before placing them on the bed. Straw makes a good mulch, also straw cut to a coarse chaff. In some places pine-needles mixed with a certain amount of grass can be obtained. This is where there are pine-trees that have had the lower branches lopped off, and grass is growing beneath the trees. The mixture of grass softens the needles. Grass cut from lawns should not be used; it goes mouldy, and imparts a bitter flavour to fruit that lies on it.

Cape gooseberries should be planted. In open plots the best arrangement of the plants is in clumps of three, about 5 ft. apart each way. The three plants lock together, and wind will not disturb them. Put out at the distance mentioned the plants should cover all the ground by autumn. In the meantime keep the soil well cultivated while it can be got at. Last season's plants should now be cut down to within 6 in. of the ground. Frost may have killed the tops, in which case there should be new growths springing up. These should not be interfered with: merely remove the dead branches.

LIVE-STOCK SLAUGHTERED.

THE following are the numbers of each class of stock slaughtered under direct inspection, throughout the Dominion, during the year ended 31st March, 1917:—

Cattle, 328,708. Sheep, 3,341,910. Swine, 153,444.
Calves, 19,396. Lambs, 3,411,621.

With the exception of cattle, which show an increase of 20,403, these figures show a decrease in the number slaughtered of each class compared with the corresponding figures for the previous year, the decreases being—sheep, 389,733; lambs, 653,479; calves, 14,374; and swine, 16,271.

The following table indicates the destination of the dressed carcases, those animals slaughtered at municipal abattoirs being principally for local consumption, and those slaughtered at meat-export slaughterhouses being (except in the case of swine) principally for export:—

	At Municipal Abbatoirs.	At Meat-export Slaughterhouses.	At Bacon-factories.
Cattle	85,432	243,276	..
Calves	14,247	5,149	..
Sheep	524,999	2,816,911	..
Lambs	66,532	3,345,089	..
Swine	45,107	28,848	79,489

At ordinary slaughterhouses the stock killed was as follows: Cattle, 56,421; calves, 1,210; sheep, 259,374; lambs, 20,332; swine, 14,445.

In addition, 34,965 pigs were killed and dressed by farmers under the exemption clause of the Slaughtering and Inspection Act, the dressed carcases being inspected in butchers' shops and small bacon-factories.

Details of the cattle, exclusive of calves, slaughtered for export during the last four years are as follows:—

Year ended 31st March.	Bullocks and Heifers.	Cows.	Bulls.	Total.
1914 ..	63,378	36,364	9,937	109,679
1915 ..	112,414	58,247	11,459	182,120
1916 ..	104,497	94,314	12,520	211,331
1917 ..	127,446	103,877	11,953	243,796

ANSWERS TO CORRESPONDENTS.

IN every instance a question to which an answer is desired in the *Journal* must be accompanied by the full name and the postal address of the inquirer, not necessarily for publication, but as a guarantee of good faith. The question should be written on one side of the paper only.

CONTROL OF GRASS-GRUB.

"ANXIOUS," Otorohanga :—

Kindly advise as to the best method of getting rid of the grass-grub. I have had several paddocks completely eaten out of grass. The land was laid down in grass, principally clovers, four years ago.

The Fields Division :—

Land badly infested with grass-grub should be used for some forage- or root-crop purpose before being again laid down in grass, and for this purpose a rape crop is about the best. The heavy trampling with stock during the egg-laying and early stages of the insect's development which is secured by growing rape appears to be an excellent method of control, and if the ground is free-working a little autumn cultivation would make it suitable for grassing after the last feeding-off. A potato crop can generally be grown successfully on grass-grub-infested land, and the same is true of late-sown turnips or mangels. When ground is used for this purpose spring-sown grass can follow the root crop, and it is advisable to add rape to the mixture so as to get a good deal of stock-trampling during the early development of the grass.

LICE ON CALVES.

G. E., Warkworth :—

Every year my calves become lousy before they are weaned, and this seems strange, as they are well fed and carefully housed in a well-ventilated house in which the bedding is changed frequently. The animals have the run of a clean grass-paddock when quite young. The cows are perfectly clean and healthy. The paddock used for the calves is very sandy. Do the lice live in the sand, and what measures should be adopted for their extermination? What is the best preparation for treating young calves?

The Live-stock Division :—

It is a mistake to assume that only calves in poor condition are subject to lice. Any good-conditioned animal suffers from lice if subjected to infection, and when lice become numerous the animal goes off in condition. A good preparation to apply consists of 1 part paraffin and 8 parts of fish-oil, well mixed. Pour along the backbone and rub the sides with the hand as the oil descends; also treat the neck, head, and ears. This should be repeated a week later, when the results should be in evidence. Lice and fleas live and breed on dry sandy country for a considerable time after the animals upon which they have been feeding are removed, and, as the insects have a tendency to live in colonies, it might be advisable to turn that piece of land over if possible.

NEWLY BROKEN SCRUB LAND AND ROOT-FUNGUS.

C. J., Rotorua :—

I have just planted out a thousand young fruit-trees on land that was quite recently in fern and tea-tree, and the ground is full of bits of stick and fern. There is a white sort of fungus or mould on a lot of this rubbish, and I am told it attacks

the roots of the young trees and kills them. Is there anything I can put in the soil to prevent it? Is the root-fungus likely to carry off the trees wholesale or just an odd one here and there?

The Horticulture Division :—

The rubbish and fern and tea-tree which you say has been ploughed in must be a source of danger of root-fungus attacks, though in similar cases trees have not been extensively affected, but only trees here and there. No one can foretell the extent of the damage, if any. Recognizing that the rubbish is a source of danger, you should take opportunities to burn any of it brought up by harrowing or other means. A dressing of lime—1 ton per acre—would be beneficial. If the trees show signs of attack a dressing of lime and sulphur may be given around them; it has been known to have good results. About 3 lb. lime and 1 lb. sulphur per tree would suffice. Sulphate of iron is also advised, 2 lb. to 3 lb. to each tree up to about five years old, increasing the amount for older trees. Kainit is considered to have resistant properties against root-fungus. For young trees 1 lb. per tree would be sufficient, spread round the tree over a radius of 3 ft. to be applied in spring.

BARREN EARS IN MAIZE CROP.

H. E. Vazey, Opotiki :—

In plucking my maize this year I found for a considerable distance in the row good and well-filled cobs of grain, and then half a dozen or more stalks with nothing but empty husks, and so on right through the crop. Would it be the fault of the wet season, or is the seed to blame, it having been saved from the same source year after year? The soil on which this crop was grown is light, fairly low-lying, cabbage-tree swamp, with pumice down about 3 ft.

The Fields Division :—

A percentage of barren ears occurs in all crops, and it is held that the planting of maize which has been grown for a number of years in the same environment *without selection* tends to aggravate the trouble. The view is also held that barrenness is more of a seasonal manifestation than an inherited characteristic. The matter is under investigation by maize-breeders. It would be well for you, at any rate, to procure a change of seed from a grower located on heavier land, preferably choosing your cobs out of the crib, and topping and tailing them. Try also the effect of 1½ cwt. per acre of superphosphate with the crop.

RAISING SEED FROM FIELD-ROOTS.

"Novice," Ngapara :—

I have pitted several choice samples of Long Red mangels, Yellow Globe mangels, carrots, parsnips, and beet with the object of raising seed from them. Kindly inform me when these should be replanted, and how. Should the whole of the root be embedded in the soil? Will it hurt to cut off some of the long tapering root? Also will the seed from roots pitted be any better than seed from those left as they grew?

The Fields Division :—

The selected roots mentioned should be placed in the ground in the spring when all danger of frost is past. They should be set in the ground to the full extent of the root, and the inflorescence or flowering and seed-bearing portion will require staking and tying later. The root should not be cut except in the case of parsnips, when only the thinnest tapering portion can be severed. The seed from the roots left as they grew should be as good as, if not better than, the seed from pitted roots, provided that they are selected for quality and size as are the pitted roots, and provided that the roots withstand winter injury, which is likely to occur in localities of much frost or much rainfall prevalence. As this withstanding is a doubtful factor in your district, it would be advisable for you to pit the selected roots or to store them in sand in a dry cellar until ready to set out. As mangels cross-fertilize rather readily, it is also necessary to keep the various varieties a good distance apart—in separate fields if possible.

DEAD-SHEEP SKINS.

"DEAD SHEEP," Te Kuiti :—

Kindly give a receipt for a cheap preparation for removing the wool from dead-sheep skins. Would the wool be worth more if shorn off than sold on the skins ?

The Live-stock Division :—

For removing wool off dead-sheep skins a cheap and efficient preparation is as follows : Mix 1 lb. caustic soda with 2 gallons water. Add sufficient slacked lime to make a good thick paste. Paint this mixture on the flesh side of the skin with a swab or whitewash-brush immediately after skinning. Afterwards fold the skin and leave until next day, when the wool can be easily removed. Care should be taken that the mixture does not get on the hands. It does not pay to shear "dead" skins, the pelts being of practically no value. Woolly skins give a better return, seeing that an all-round price is obtained for the pelt and the wool.

SCALE-INFESTED LEMON-TREES.

"INQUIRER," Rapaura :—

Kindly let me know the reason why the skins of my lemons go black and rough. The fruits look as though they would rot. The black matter can be wiped off fairly well with a damp cloth, but still the skin remains rough, and this spoils the sample. Also please say why the leaves of the trees have a black sooty appearance, and kindly indicate the remedy.

The Horticulture Division :—

Your lemon-trees are evidently infested with scale insects. The insects are now in a dormant state, and an insecticide of sufficient strength to kill them would injure the trees. The young scale will hatch out in October, and the trees should then be sprayed with red-oil emulsion, 1 in 40. The sooty matter is the excreta of the insects.

PREVENTIVES OF POTATO-SCAB.

"NOVICE," North Otago :—

In the June number of the *Journal* sulphur is recommended as a preventive of potato-scab, also the use of acid manures. How much sulphur should be sown per square pole ? Would kainit be a suitable manure under the circumstances ?

The Horticulture Division :—

As a preventive of potato-scab about 2½ lb. of sulphur per square rod should be sown. Superphosphate, which is an acid form of lime, would be more suitable than kainit. The value of the formalin remedy described in the June *Journal* is particularly stressed by scientific authorities.

NOTICE.—An answer cannot be given to "Akarana" unless he furnishes his name and postal address.

THE COMING SEASON'S WOOL-CLIP.

IN view of an impending requisition of the New Zealand wool-clip for the coming season, regulations have been gazetted, under date 10th August 1917, prohibiting the sale and purchase of wool being part of such clip excepting (1) any wool which is or has been the property of the Crown; (2) any sale of wool to the Crown; (3) any transaction to which the Controllor of the Imperial Supplies Department has given his previous consent in writing on being satisfied that the wool concerned is not required by the Crown.

AGRICULTURAL AND PASTORAL STATISTICS—SEASON 1916–17.

THE statistics presented in the following tables were issued by the Government Statistician under date 31st July, 1917. Owing to a few returns being outstanding certain estimates have had to be made for incomplete portions, and the figures given in such cases are subject to slight revision.

INTERIM RETURNS.

I.—TABLE SHOWING APPROXIMATE AREAS AND YIELDS OF THE PRINCIPAL CROPS IN EACH LAND DISTRICT IN THE DOMINION FOR THE SEASON 1916–17.

Land District.	Wheat.					Oats.					Barley.			
	For Threshing.		For Chaff, Hay, or Ensilage.		Not harvested (Fed off, &c.).	For Threshing.		For Chaff, Hay, or Ensilage.		Not harvested (Fed off, &c.).	For Threshing.		For Chaff, Hay, or Ensilage.	
	Area.	Yield.	Area.	Yield.		Area.	Yield.	Area.	Yield.		Area.	Yield.	Area.	Yield.
	Acres.	Bushels.	Acres.	Tons.	Acres.	Acres.	Bushels.	Acres.	Tons.	Acres.	Acres.	Bushels.	Acres.	Tons.
Auckland	573	11,696	114	149	36	368	6,393	21,009	25,811	856	484	12,037	105	275
Hawke's Bay	319	7,940	173	344	72	1,104	27,923	12,791	19,184	821	2,576	96,253	319	459
Taranaki	423	11,257	53	108	32	519	13,110	6,923	13,071	301	370	12,290	111	209
Wellington	4,996	120,950	297	377	79	7,775	239,714	18,375	29,297	1,680	941	28,339	124	261
Nelson	826	12,382	46	66	19	951	18,228	9,245	10,570	138	1,600	25,500	2	2
Marlborough	1,289	23,328	206	306	435	1,677	47,390	18,180	35,362	1,757	7,969	159,542	98	75
Westland	2	16	..	..	..	..	..	521	627	47	..	..	..	..
Canterbury	178,545	3,960,182	2,354	3,253	1,728	82,507	2,067,451	159,416	157,654	22,788	9,013	202,150	226	9,204
Otago	30,318	862,214	417	847	311	45,377	1,627,754	62,449	82,633	3,544	6,247	188,574	57	137
Southland	1,830	45,492	40	65	162	38,119	1,422,442	43,707	56,025	568	370	13,297	73	133
Totals, Dominion, 1916–17 (interim figures only)	219,121	5,055,457	3,700	5,515	2,874	178,397	5,470,405	352,616	430,234	32,500	29,570	737,982	1,115	10,755
Totals, Dominion, 1915–16 (final figures)	329,207	7,108,360	6,215	7,440	..	212,688	7,653,208	429,437	572,435	..	30,204	820,174	2,040	3,387

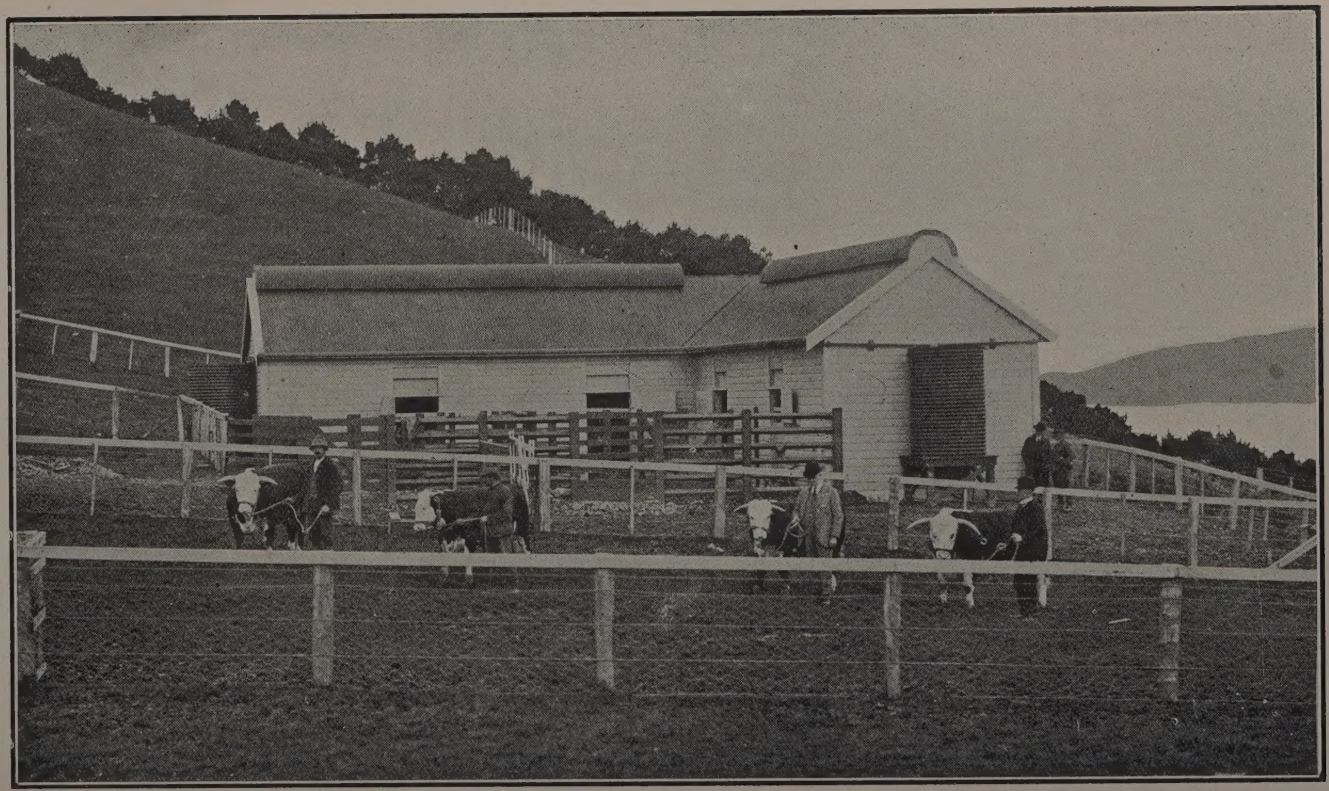
I.—Table showing Approximate Areas and Yields of the Principal Crops in each Land District in the Dominion for the Season 1916–17—*continued.*

Land District.	Maize.				Rye-grass.		Cocksfoot.		Potatoes.		Turnips.	Mangels.
	For Threshing.		For Ensilage.									
	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.		
	Acres.	Bushels.	Acres.	Tons.	Acres.	Lb.	Acres.	Lb.	Acres.	Tons.	Acres.	Acres.
Auckland	3,314	119,010	511	3,667	1,078	221,285	977	55,235	3,020	10,915	77,012	537
Hawke's Bay	3,070	162,919	60	683	4,896	1,492,990	491	24,212	923	4,231	11,576	479
Taranaki	13	372	26	116	96	29,119	80	7,114	399	1,558	35,041	1,375
Wellington	23	761	55	333	2,523	571,438	654	82,271	2,389	12,917	40,653	788
Nelson	7	157	2	20	84	10,800	107	5,600	486	1,804	5,164	20
Marlborough	7	200	5	101	1,290	338,054	280	25,005	361	1,476	2,725	310
Westland	..	..	..	..	..	..	1	1,400	41	166	2,107	2
Canterbury	..	..	8	13	48,061	10,525,696	11,579	1,505,985	12,781	68,106	122,219	3,978
Otago	..	..	1	1	7,931	2,714,637	466	52,056	3,508	19,372	116,197	1,466
Southland	..	..	..	..	13,441	7,424,287	98	12,838	1,594	10,262	118,802	27
Totals, Dominion, 1916–17 (interim figures only)	6,434	283,419	668	4,934	79,400	23,328,306	14,733	1,771,716	25,502	130,807	531,496	8,982
Totals, Dominion, 1915–16 (final figures)	8,086	340,372	624	3,493	43,095	15,908,312	13,293	1,577,285	29,809	128,807	572,138	13,046

[*Average Yields.*—On the above figures average Dominion yields per acre for the 1916–17 season work out as follows: Wheat, 23·07 bushels; oats, 30·66 bushels; barley, 24·95 bushels; maize, 44·05 bushels; rye-grass, 293·80 lb.; cocksfoot, 120·25 lb.; potatoes, 5·12 tons.]

II.—Table showing the Approximate Numbers of the Principal Varieties of Live-stock in each Land District in the Dominion (inclusive of its Interior Boroughs).

Land District.	Horses, as at 31st Jan., 1917.	Dairy Cows, as at 31st Jan., 1917 (in Milk and Dry).	Total Cattle, as at 31st Jan., 1917 (including Figures in Previous Column).	Number of Sheep shorn, Season 1916–17.	Number of Lambs tailed, Season 1916–17.	Sheep, as at 30th April, 1917.	Pigs, as at 31st Jan., 1917.
Auckland	89,960	251,484	820,210	1,704,455	780,299	1,792,176	86,678
Hawke's Bay	37,837	42,662	342,061	5,211,671	2,403,058	5,961,553	15,724
Taranaki	25,855	154,406	334,773	961,282	386,221	983,822	50,428
Wellington	51,735	131,895	493,427	5,059,524	2,551,621	5,473,850	47,263
Nelson	9,011	18,034	51,413	407,780	179,167	456,991	8,889
Marlborough	7,318	10,583	30,304	949,693	386,707	1,017,629	7,107
Westland	3,254	9,475	37,108	56,334	27,156	62,271	2,953
Canterbury	69,348	55,468	146,782	3,876,742	2,136,453	4,377,407	36,339
Otago	42,656	45,778	122,017	2,585,982	1,121,647	2,911,057	14,270
Southland	30,193	40,323	124,605	1,367,361	706,251	1,716,568	8,535
Totals, Dominion, 1917 (interim figures) ..	367,167	760,108	2,502,700	22,180,824	10,678,580	24,753,324	278,186
Totals, Dominion, 1916 (final figures) ..	371,331	750,323	2,417,491	22,097,268	10,370,771	24,788,150	297,501



Imported Herefords at Somes Island Quarantine-station.